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Fur Seal Investigations, 1968

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SPECIAL SCIENTIFIC REPORT-FISHERIES No. 617

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Fur Seal Investigations, 1968

by

NATIONAL MARINE FISHERIES SERVICE
MARINE MAMMAL BIOLOGICAL LABORATORY
Sand Point Naval Air Station
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ABSTRACT

Field investigations in 1968 were made on the Pribilof Islands from June to October, in Washington waters in November-December 1967 and January-February 1968, and in Alaska waters from May to August 1968. Data were collected during these periods for studies of population levels and the maximum sustained yield, and the distribution, feeding habits, migrations, and pregnancy rates of fur seals.

In 1968, 45,625 male and 13,335 female fur seals (Callorhinus ursinus) were killed on the Pribilof Islands.

Dead fur seals counted included 31,438 pups and 350 animals older than pups.

The major causes of death among 379 pups were malnutrition, hookworm disease, trauma, infections, and perinatal complex.

We estimated that the Islands had 7,924 harem and 4,383 idle males in mid-July.

Pregnancy rates of females were 42 percent for 1,058 from hauling grounds in 1968 and 100 percent for 221 from rookeries in 1957.

The average weights of the pups were 9.6 kg. for males and 8.3 kg. for females.

Seals tagged included 11,675 pups regardless of sex, 714 males estimated to be yearlings, and 1,495 males estimated to be 2 years old.

Of the marked seals recovered, 3,946 had been given tags or other marks as pups and 1,197 had been tagged at age 1 or older.

Tag loss apparently is highest soon after tagging.

The recovery rate for pups tagged in September has been higher than that for pups tagged in August.

Pups marked by removing parts of flippers apparently have a higher survival rate than pups that have been given tags and flipper marks.

Two different methods of estimating populations yielded similar values (400,000 and 350,000) for the number of pups born in 1965. The pup population estimates decreased annually since 1960 to less than 400,000 in 1965.

Estimates of the number of yearling males for several year classes are 82,000 (1961), 79,000 (1962), 115,000 (1964), and 80,000 (1965).

After the kill in 1966, the population still included 25,000 3-year-old males from the 1963 year class and 70,000 2-year-old males from the 1964 year class.

The predicted kill of males in ages 2 to 5 was 49,000 for 1968 and is 56,000 for 1969. The actual kill in 1968 was 44,162.

The recovery rate of young males tagged and recovered in 1968 was higher for those marked in June than for those marked in July. The recovery rate for seals tagged on hauling grounds inaccessible to the kill was less than that for seals tagged on accessible hauling grounds. One of ten transmitters attached to seals emitted signals for 9 days.

Nearly all of 250 adult males killed from rookeries were age 10 or older, but 58 percent of 100 adult males killed from hauling grounds were less than 10 years.

Researchers took 374 seals off Washington and 456 in Alaska waters; 38 of these seals had tags or other marks. About 50 percent of the female seals taken were from 1 to 7 years old.

The principal fishes eaten by fur seals off Washington were salmon, Oncorhynchus spp.; anchovy, Engraulis mordax; rockfish, Sebastodes spp.; eulachon, Thaleichthys pacificus; and capelin, Mallotus villosus. The principal foods consumed in Alaska waters were walleye pollock, Theragra chalcogrammus; squids, Cephalopoda; and Atka mackerel, Pleurogrammus monopterygius.

INTRODUCTION

The year 1968 marks an important step in studies of the Pribilof Islands fur seal population.

Now, 13 years after we first began to reduce the seal population with the expectation that a smaller population would yield larger kills and more stability, we are ready to let it increase in size. The high population of the 1950's has been reduced and held at nearly the same level since 1963. An estimate of the mean kill of males from the year classes at this lower population level and the size of fluctuations to be expected in the kill will be determined from collections of data completed by 1972.

The next step will be to find the productivity of the population when it reaches a new, higher level.

Information about marked seals continues to upset any of our previous notions about the purity of separate populations in the North Pacific. A small colony of seals that produced young in 1968 on San Miguel Island, off the coast of California, included marked animals from the Pribilof and Commander Islands. A male seal marked in late June 1968 on the Pribilof Islands was taken on the Commander Islands within a month.

Part I, on land investigations, was prepared by Raymond E. Anas, Douglas G. Chapman (Director of the Center for Quantitative Analysis, University of Washington), Ancel M. Johnson, Mark C. Keyes, Alton Y. Roppel, and Ford Wilke.

Part II, on pelagic studies, was contributed by Clifford H. Fiscus and Hiroshi Kajimura.

Part I. FUR SEAL INVESTIGATIONS, PRIBILOF ISLANDS, ALASKA, 1968

The purpose of fur seal research on the Pribilof Islands is to appraise the reaction of the herd to population levels purposely adjusted so that the level of maximum sustained yield can be calculated. Part I of this report summarizes the information collected in 1968 and describes the progress made toward the achievement of this goal. The glossary describes terms having special meanings in fur seal research, figures 1 and 2 show the location of rookeries and hauling grounds on St. Paul and St. George Islands, and Appendix B lists persons engaged in fur seal research on the Pribilof Islands in 1968. In this report, "Pribilof Islands" includes St. Paul and St. George Islands and, occasionally, Sea Lion Rock. There are no fur seal rookeries on Walrus and Otter Islands, two of the five islands belonging to the Pribilof group.

AGE CLASSIFICATION AND NUMBER OF SEALS KILLED BY SEX

Seals of both sexes were taken on the Pribilof Islands from 26 June to 16 August 1968; males were killed primarily from 26 June to 2 August, and females from 3 to 16 August.

MALES

All available males 42 inches (107 cm.) long or longer from tip of nose to tip of tail, but without manes, were taken from 26 June to 2 August on St. Paul Island and from 26 June to 5 August on St. George Island. The animals were killed beginning at 6 a.m. Monday through Saturday on St. Paul Island and at 9 a.m. on Mondays, Wednesdays, and Fridays on St. George Island.

The lower length limit for male seals was removed on St. Paul Island from 22 to 26 July to continue a study of the relation of abundance of seals at age 2 to the number killed from the same year class a year later at age 3.

Efforts to increase the utilization of males were carried out primarily by taking as many as possible of the large 4-year-olds during the kills of males on both islands. Seals on Zapadni Point were frightened away once in an attempt to make the animals haul out on an area accessible to the kill.

Table 1 gives the kills of male seals on the Pribilof Islands from year classes 1947 to 1966.

Right upper canine teeth collected from 20 percent of the males killed on the Pribilof Islands in 1968 were used to estimate the age composition of the total kill. A kill of 44,292 males in ages 2 to 6 included 35,292 taken on St. Paul Island and 9,000 taken on St. George Island (tables A-1 to A-4). Ages were not determined for an additional 1,333 young males taken during the kill of females 3-16 August, though most of the animals were probably 3 to 4 years old. The seasonal trend in the availability of 3- and 4-year-old males killed is given in figure 3 for St. Paul Island and in figure 4 for St. George Island.

On the basis of tests of reader ability to determine the ages of seals from canine teeth (Marine Mammal Biological Laboratory, 1969) the age compositions were adjusted to show the

Figure 1.--Location of rookeries and hauling grounds, St. Paul Island.

Figure 2.--Location of rookeries and hauling grounds, St. George Island.

Table 1.--Kill of male seals, [1/] by year class, Pribilof Islands, Alaska, 1947-66

Year class	St. Paul Island					St. George Island					Grand total
	Age when killed					Age when killed					
	2	3	4	5	Total	2	3	4	5	Total	
	Number					Number					Number
1947	-	30,110	23,697	854	54,661	-	7,043	3,731	123	10,897	65,558
1948	486	25,714	19,995	103	46,298	114	5,546	3,926	22	9,608	55,906
1949	-	29,697	12,326	249	42,272	303	7,116	2,570	280	10,269	52,541
1950	855	40,656	15,365	332	57,208	1,104	8,475	4,793	147	14,519	71,727
1951	1,384	32,350	18,083	3,057	54,874	288	7,907	5,310	681	14,186	69,060
1952	1,735	30,733	31,410	675	64,553	545	8,998	8,459	506	18,508	83,061
1953	839	38,312	8,855	54	48,060	295	10,611	3,330	100	14,336	62,396
1954	2,918	23,473	5,599	554	32,544	535	6,651	2,779	162	10,127	42,671
1955	1,015	27,863	10,555	115	39,548	555	7,246	2,825	260	10,886	50,434
1956	885	10,671	2,762	532	14,850	171	2,251	1,387	218	4,027	18,877
1957	2,590	24,283	15,344	773	42,990	242	5,098	4,492	244	10,076	53,066
1958	1,977	48,458	14,149	1,587	66,171	431	9,413	3,707	540	14,091	80,262
1959	2,820	26,456	14,184	1,764	45,224	891	5,890	4,690	492	11,963	57,187
1960	1,619	14,310	10,533	1,240	27,702	636	4,332	2,579	178	7,725	35,427
1961	1,098	22,468	12,046	1,270	36,882	921	6,948	2,592	502	10,963	47,845
1962	2,539	19,009	12,156	1,287	34,991	1,139	3,736	3,881	392	9,148	44,139
1963	1,264	25,535	11,785	1,542	40,126	167	5,586	3,738	406	9,897	50,023
1964[2/]	3,143	26,991	13,279	--	43,413	391	7,622	3,680	--	11,693	55,106
1965[2/]	2,200	18,706	--	--	20,906	740	4,443	--	--	5,183	26,089
1966[2/]	1,673	--	--	--	1,673	443	--	--	--	443	2,116
Mean	1,724	27,147	14,007	940	[3/]43,468	522	6,340	3,804	309	[4/]11,271	[3/]54,805

1/ Includes only 2- to 5-year-old seals taken during the kill of males on the Pribilof Islands. From 1956 to 1966, 131 1-year-olds and 564 6-year-olds were taken on St. Paul Island and 20 1-year-olds and 202 6-year-olds were taken on St. George Island. In addition, age was not determined for 4,919 males taken on St. Paul Island, nor for 1,522 taken on St. George Island.

2/ Incomplete returns.

3/ 1947, 1949, 1964, 1965, and 1966 year classes not included.

4/ 1947, 1964, 1965, and 1966 year classes not included.

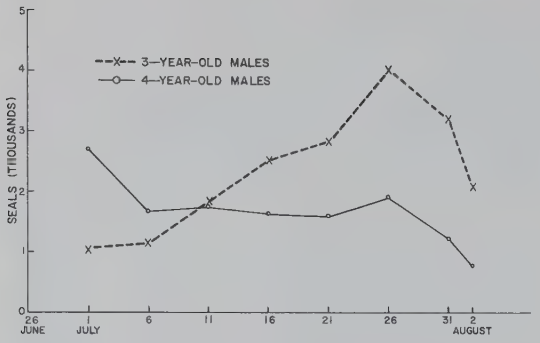


Figure 3.--Kill of 3- and 4-year-old male seals, St. Paul Island, 26 June to 2 August 1968.

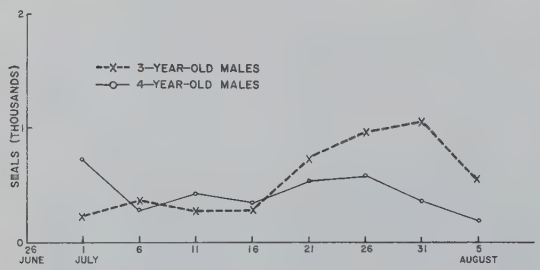


Figure 4.--Kill of 3- and 4-year-old male seals, St. George Island, 26 June to 5 August 1968.

possible magnitude of error in the number of males of each age killed in 1968. Differences between adjusted and nonadjusted age compositions were about 1 percent each for 3-, 4-, and 5-year-old males and 17 percent for 2-year-old males (table 2). The adjusted number of 2-year-old males was less than the nonadjusted number. Adjusted numbers of seals killed are not used in any of the calculations in this report because the data are similar for ages 3, 4, and 5, and it is not known if the adjusted or the nonadjusted age composition is more representative of the true age composition.

FEMALES

The 13,335 females killed on the Pribilof Islands in 1968 were considered excess to the number needed to maintain the production of pups at the present level. St. Paul Island contributed 10,544 females, and St. George Island, 2,791. Right upper canine teeth from 30 percent of the females killed were used to estimate the age composition of the total kill (tables A-5 to A-12).

The kill began about 6 a.m. Monday through Friday on St. Paul Island and about 9 a.m. Monday, Wednesday, and Friday on St. George Island. All females killed were taken from hauling grounds, and all females in the drive were killed regardless of age or size. When the kill of males ended 2 August on St. Paul Island and 5 August on St. George Island, 1,233 and 173 females, respectively, had been taken. The relative size of each rookery was used as a guide in killing the remaining 11,594 females needed to achieve a quota of 13,000 (table 3). A special effort was made not to exceed the quotas on Reef, Polovina, and Staraya Artil, three rookeries where females are extremely accessible.

Table 4 shows the kills of females from year classes 1943-67.

Table 2.--Unadjusted and adjusted kill of male seals, Pribilof Islands, Alaska, 26 June to 5 August 1968

Age	Unadjusted kill	Adjusted kill	Difference
Years	Number	Number	Percent
2	2,106	1,802	+16.87
3	23,149	23,339	- 0.81
4	16,959	17,099	- 0.82
5	1,948	1,923	+ 1.30
Total	1/ 44,162	1/ 44,162	

1/ We did not include 130 6-year-old males taken on the Pribilof Islands 26 June to 5 August, nor 307 males killed on St. Paul Island 3 and 5 August because the data for these seals were incomplete.

Table 3.--Number of female seals to be killed and the number actually taken during a special kill of female seals, Pribilof Islands, Alaska, August 1968

Island and rookery	Quota	Actual kill
St. Paul Island:	Number	Number
Northeast Point.....	2,129	2,829
Tolstoi-Zapadni Reef.	1,022	962
Zapadni-Little Zapadni.....	1,874	2,137
Reef.....	1,789	1,417
Lukanin-Kitovi.....	596	592
Polovina.....	1,107	1,374
Total.....	8,517	9,311
St. George Island:		
Zapadni.....	800	854
North.....	1,262	1,032
East.....	615	513
Staraya Artil.....	400	219
Total.....	3,077	2,618

Table 4.--Kill of female seals, by year class,[1/] Pribilof Islands, Alaska, 1943-67

Year class	Age in years					
	1	2	3	4	5	6
	Number					
1943	-	-	-	-	-	12
1944	-	-	-	-	3	11
1945	-	-	-	4	4	8
1946	-	-	-	4	4	60
1947	-	1	-	1	37	84
1948	-	-	-	84	75	94
1949	-	-	30	34	161	118
1950	-	10	17	92	210	2,949
1951	4	-	8	85	4,618	6,343
1952	-	-	16	6,422	11,465	3,408
1953	-	1	2,132	5,806	4,056	2,958
1954	-	132	1,150	8,493	3,771	683
1955	--	11	11,468	7,285	1,047	4,810
1956	-	601	2,072	614	4,520	3,444
1957	150	281	352	6,912	6,303	4,080
1958	76	79	4,651	8,683	8,697	1,914
1959	27	508	4,563	8,044	3,626	621
1960	120	431	2,979	3,409	1,121	46
1961	37	724	3,434	2,629	85	1,193
1962	7	390	1,384	93	1,571	1,673
1963	26	172	45	1,597	1,908	
1964	12	13	963	2,791		
1965	58	33	789			
1966	10	65				
1967	84					

1/ Includes pelagic research kill of the United States and Canada, 1958-68. In addition, 138,665 females age 7 and older and 7,067 females of undetermined age were taken.

SURVEY DATA

Data were collected on: (1) numbers of dead pups, (2) causes of pup mortality, (3) seasonal and annual trends in pup mortality, (4) number of dead adults, (5) number of living adult males, (6) reproductive condition of females, and (7) weights of living pups.

DEAD SEAL PUPS COUNTED

Total counts of dead pups have been made after 15 August on the Pribilof Islands nearly every year since 1941. About twice as many were counted in 1968 than in 1967 (table A-13). Of 31,438 dead pups counted in 1968, 26,563 were on St. Paul Island and 4,875 were on St. George Island.

In 1966, the rookeries on St. Paul Island were subdivided into sections that contained about 100 class 3[1] males counted on land in mid-July 1965. Records of counts by section (table A-14) have now been kept for 3 years. Mortality, according to the counts, does not vary uniformly on all rookeries nor on sections of rookeries. For example, the counts of dead pups on Polovina Cliffs Rookery were 809, 825, and 1,616 in 1966, 1967, and 1968, respectively, but the total counts (nearest 1,000) for St. Paul Island in each of the 3 years were 21,000, 14,000, and 27,000. Apparently the mortality differs among the rookeries, and if true, mortality from various causes probably varies among rookeries and sections of rookeries within a year.

[1] Territorial males with females.

CAUSES OF SEAL PUP MORTALITY

Malnutrition, hookworm disease, trauma, multiple hemorrhage-perinatal complex, and microbial infections of various kinds caused most of the pup deaths on three study areas on St. Paul Island in 1968. These and miscellaneous causes of death among pups are discussed in this section.

From 4 July to 15 August 1968, 379 dead pups were collected from catwalks on study areas at Reef and Northeast Point Rookeries (figs. 5 and 6). Of these dead pups, 324 were autopsied and 55 were discarded because of advanced post mortem degeneration. An additional 34 pups that had died on the study areas before we began our research in 1968 were also discarded when the areas were first cleared on 4 and 5 July. We know, however, that few pups die from malnutrition before 17 July, and we can safely assume that none of the 34 pups died from hookworm disease because the earliest deaths from this cause have been observed about 17 July in past years. Twenty-one dead pups that we discarded after 5 July were unsuitable for examimation because of extremely rapid putrefaction, probably preceded by bacterial infection. Emaciated pups deteriorate relatively slow, and hookworm disease can usually be recognized in spite of post mortem change. Thus, we would have discarded few pups that died from these causes. The cause of death was not determined for 12 of the 324 pups examined, but we know these animals did not die of malnutrition or hookworm disease. Therefore, the proportions of

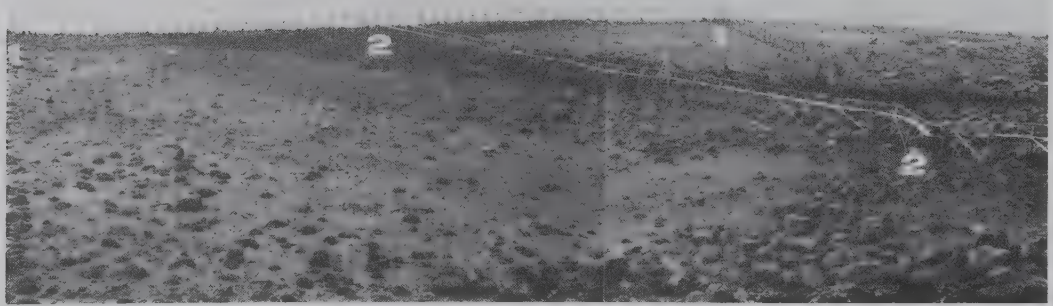


Figure 5.--Seal pup mortality study areas 1 and 2, Reef Rookery, St. Paul Island, mid-July 1968.

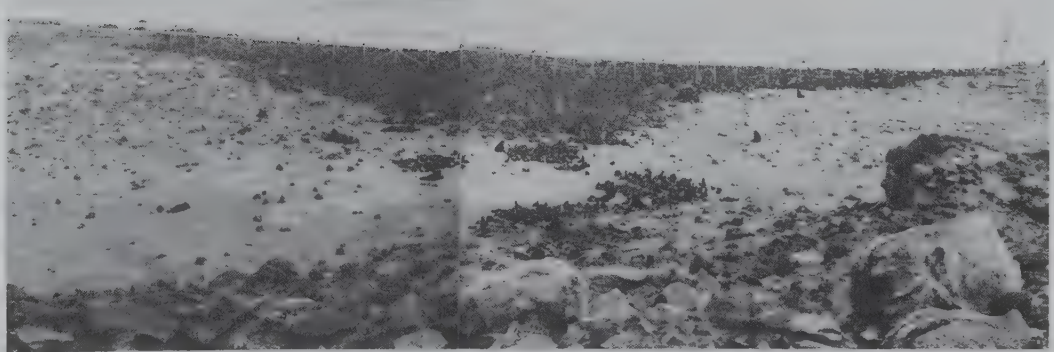


Figure 6.--Seal pup mortality study area 3, Northeast Point Rookery, St. Paul Island, mid-July 1968.

Table 5.--Primary causes of death among seal pups within three mortality study areas, St. Paul Island, 4 July to 15 August 1968

Causes of death	Study area						Total	
	Reef Rookery				Northeast Point			
	Area 1 Old catwalk		Area 2 New catwalk		Area 3 Hutchinson Hill			
	Dead pups		Dead pups		Dead pups			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Malnutrition	80	60.7	42	43.2	59	39.3	181	47.8
Hookworm disease	7	5.3	7	7.2	50	33.3	64	16.9
Trauma	11	8.3	5	5.2	5	3.3	21	5.5
Bite wounds	(7)	(5.2)	(3)	(3.1)	(3)	(2.0)	(13)	(3.4)
Skull fractures	(0)	(0.0)	(1)	(1.0)	(1)	(0.7)	(2)	(0.5)
Contusions	(0)	(0.0)	(0)	(0.0)	(1)	(0.7)	(1)	(0.3)
Stomach rupture	(3)	(2.3)	(1)	(1.0)	(0)	(0.0)	(4)	(1.0)
Heart rupture	(1)	(0.8)	(0)	(0.0)	(0)	(0.0)	(1)	(0.3)
Multiple hemorrhage-perinatal complex	4	3.0	9	9.3	6	4.0	19	5.0
Infection (microbial)	2	1.5	5	5.2	13	8.7	20	5.3
Navel	(0)	(0.0)	(3)	(3.1)	(1)	(0.7)	(4)	(1.0)
Peritonitis	(0)	(0.0)	(1)	(1.0)	(2)	(1.3)	(3)	(0.8)
Pleuritis	(0)	(0.0)	(0)	(0.0)	(2)	(1.3)	(2)	(0.5)
Enteritis	(2)	(1.5)	(1)	(1.0)	(7)	(4.7)	(10)	(2.6)
Pneumonia	(0)	(0.0)	(0)	(0.0)	(1)	(0.7)	(1)	(0.3)
Miscellaneous	3	2.3	3	3.1	1	0.7	7	1.8
Stillborn	(3)	(2.3)	(1)	(1.0)	(1)	(0.7)	(5)	(1.3)
Meconium impaction	(0)	(0.0)	(1)	(1.0)	(0)	(0.0)	(1)	(0.3)
Congenital pneumonia	(0)	(0.0)	(1)	(1.0)	(0)	(0.0)	(1)	(0.3)
Undetermined	3	2.3	6	6.2	3	2.0	12	3.2
Unsuitable for examination	22	16.6	20	20.6	13	8.7	55	14.5
Total	132	100.0	97	100.0	150	100.0	379	100.0

deaths given in table 5 for malnutrition and hookworm disease are based on a total that includes pups unsuitable for examination and pups for which the causes of death were undetermined.

Malnutrition

The causes of apparent malnutrition of fur seal pups is not well understood. If death from malnutrition depends on separation of mother and pup and if the extent of separation depends on crowding, then mortality from malnutrition should have been at about the same level since 1963. Mortality from malnutrition, however, has varied from 25 to 61 percent on study area 1 of Reef Rookery from 1964 to 1968. We believe that the density of the present population is below the level where density dependent mortality factors are important. Separation of mother and pup owing to crowding is probably not the only cause of malnutrition. Perhaps some disease is involved. For example, a disease affecting the mother could stop the flow of milk (agalactia), a condition we have observed in two females captured at the time of parturition. A disease affecting the pup could also interrupt feeding. Any infectious disease with a duration of from 1 to 3 weeks would outwardly manifest itself in the pup by a loss of weight and other condition. Certain types of viruses can cause a loss of appetite (anorexia) without observable gross lesions until those caused by secondary bacterial invasion appeared. Actually, most pups that die of apparent malnutrition are emaciated but have no other observable gross lesions except an apparent secondary bacterial enteritis (table 6). We have not been able to positively differentiate between malnutrition caused by disease and that caused by simple starvation.

Hookworm Disease

"Hookworm disease" refers to the presence of sufficient numbers of the parasite in the

Table 6.--Seal pups that died of malnutrition with secondary bacterial enteritis, all mortality study areas, St. Paul Island, 1964 and 1966-68

Year	Total deaths from malnutrition 1/	Pups with secondary bacterial enteritis	
	Number	Number	Percent
1964	41	23	56.1
1966	69	40	58.0
1967	72	27	37.5
1968	181	77	42.5

1/ Permanent canine teeth had not erupted in 70.7 percent of pups that died of malnutrition, indicating that deaths from this cause usually occur before the age of 3 to 4 weeks. Permanent canine teeth usually erupt in females by the third week and in males by the fourth week.

intestinal tract to cause hemorrhagic anemia, focal intestinal ulceration, inflammation, and, in some cases, perforation.

Although the percentage of deaths from hookworm disease for all areas combined in 1968 (16.9 percent) was nearly the same as in 1967 (16.0 percent), the actual number increased from 37 to 64.

The first cases of hookworm disease were found on Reef Rookery 10 July 1968, 1 week earlier than usual. The incidence there (6.3 percent) was much lower than on Northeast Point (33.3 percent). We can only speculate that the reason for this and a similar difference noted in 1967 is because of different topography, or a cyclic variation in the level of passive resistance transmitted from mothers to their pups.

The permanent canine teeth had not erupted in 71.9 percent of the pups that died of hookworm disease, indicating that the pups died from this cause before they were 3 to 4 weeks old.

Trauma

Eight pups with ruptured livers did not have definite symptoms of the multiple hemorrhage-perinatal complex other than liver hemorrhage and may have been trampled by adult seals. For example, we assume that trampling ruptured a heart and four stomachs, fractured two skulls, and gave one pup severe contusions. In addition, 13 pups died of infection or hemorrhage owing to bite wounds.

Multiple Hemorrhage-Perinatal Complex

Thirty to forty percent of the pups that have died of this complex have been stillborn, and 67 to 80 percent have had fresh umbilical cords or placentas; hence the designation "perinatal" (around birth). Except for liver rupture, the most constant lesion has been hemorrhage, usually from the liver but from other organs also, and peculiarly, within the eyes (20-44 percent). Affected livers are usually friable, swollen, and easily ruptured, and often have blood blisters and focal necrosis on their surfaces. One affected pup (necropsy number 68-N-133) had subcapsular hemorrhages of the liver and generalized jaundice, but the liver had not ruptured. Table A-15 shows the lesions and circumstances associated with this disease. We do not know the cause but suspect a virus infection, or some toxic process. Although attempts to culture a virus from the liver of affected seals using tissue culture cell lines from human embryonic kidney and fibroblasts, and African Green Monkey kidney,[2] were negative, the results were inconclusive because we were unable to try tissue culture cell lines from the fur seal.

Infection (Microbial)

The most prevalent form of microbial infection (table 5) was enteritis, the primary cause of death in 10 pups and the secondary cause in 77. Navel infection (omphalophlebitis) in 1968 was lower than expected (1 percent), but pups that die of this cause deteriorate rapidly and some may have been overlooked among those classified as unsuitable for examination. Bite wounds in nine pups caused fatal secondary infections.

Miscellaneous

This category included five stillbirths, one meconium impaction, and one congenital pneumonia. Among those that died of the multiple-hemorrhage-perinatal complex, 7 were stillbirths, bringing the total to 12 stillbirths (3.2 percent) among 324 pups.

SEASONAL AND ANNUAL TRENDS IN SEAL PUP MORTALITY

Table A-16 shows the causes of death by 7-day periods on St. Paul Island. The number of deaths was highest from 26 July to 1 August when most were caused by malnutrition and hookworm disease. Most of the deaths from all other causes occurred before 26 July.

Figures 7 and 8 compare mortality for 4 years on area 1, Reef Rookery, and for 2 years on area 3, Northeast Point. The relative size of the five major causes of mortality varied significantly between years on Reef Rookery ($P<0.005$) but not on Northeast Point ($P=0.25$). The causes of death that deviated most from

[2] This work was done by Dorothy F. Scott, Department of Microbiology, Presbyterian-St. Luke's Hospital, Chicago, through the courtesy of Friedrich Deinhardt, Chairman.

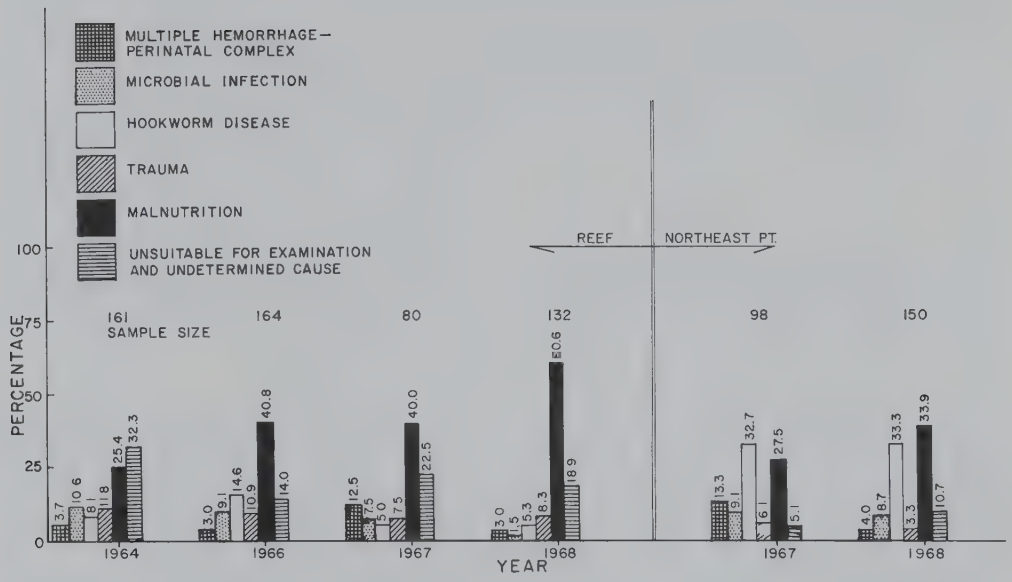


Figure 7.--Percentage of seal pups that died of various causes, Reef Rookery study area 1, 1964 and 1966-68, and Northeast Point study area 3, 1967 and 1968, St. Paul Island.

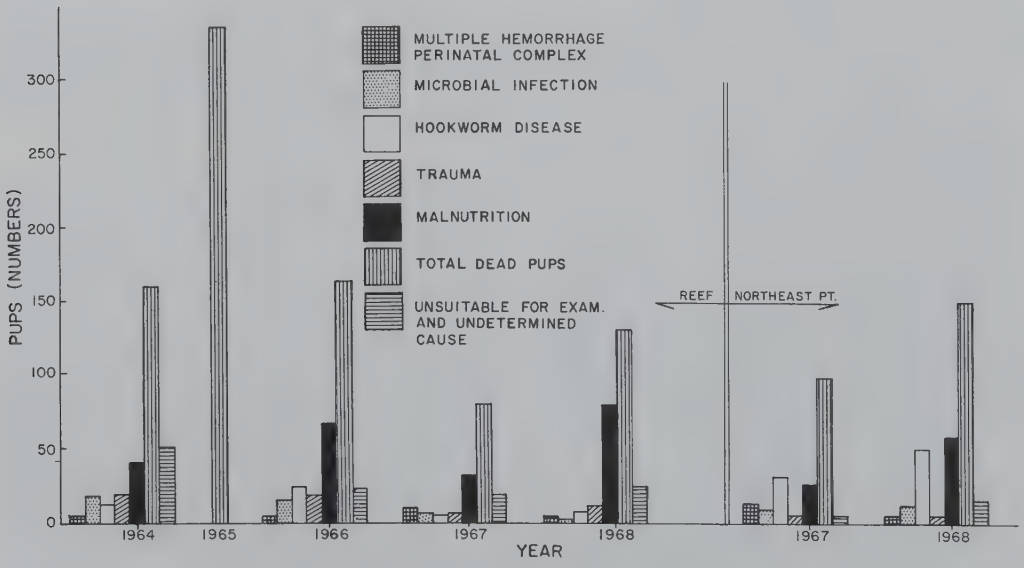


Figure 8.--Number of seal pups that died of various causes, Reef Rookery study area 1, 1964 and 1966-68, and Northeast Point study area 3, 1967 and 1968, St. Paul Island.

the average were microbial infection and trauma in 1964, multiple hemorrhage-perinatal complex in 1967, and malnutrition and microbial infection in 1968.

We conclude that observed fluctuations in mortality are probably influenced by changes in the incidence of one or two causes of death rather than a general increase or decrease in the incidence of all.

DEAD SEALS COUNTED THAT WERE OLDER THAN PUPS

All beaches of St. Paul and St. George Islands are now routinely examined each year for dead fur seals older than pups. Seals of both sexes are counted, and canine teeth are collected from each for studies of age and mortality. Table 7 shows the number of dead animals counted in 1965-68, and table 8 the age composition of dead males age 6 and older in 1965-68.

Table 7.--Dead seals counted that were older than pups, Pribilof Islands, Alaska, 1965-68

Year	St. Paul Island		St. George Island		Total	
	Males	Females	Males	Females	Males	Females
	-----Number-----		------Number------		----Number----	
1965	158	No count	No count	No count	158	No count
1966	181	172	41	55	222	227
1967	108	157	41	28	149	185
1968	134	161	32	23	166	184

LIVING ADULT MALE SEALS COUNTED

In 1968, the adult males were counted on all rookeries in June and July on St. George Island (tables A-17 and A-18) and in June on St. Paul Island and Sea Lion Rock (table A-19). Since 1966, the number of adult males on St. Paul Island in July has been estimated from sample counts. For example, adult males were counted only on Reef, Zapadni Reef, Vostochni, and Morjovi Rookeries in July 1968 (table A-20). We then extrapolated these counts to produce estimated totals of 6,176 harem and 3,100 idle males for St. Paul Island, under the assumption that decreases on the sample rookeries from 1966 (the last year in which a total count of adult males was obtained for St. Paul Island in July) to 1968 (table A-21) represented similar changes on all rookeries during this period.

The total number of adult males counted on the Pribilof Islands in July has decreased annually since 1961 (table A-22). If we consider only the counts obtained in 1962 and later, which were made by the same individual, the number of harem (7,924) and idle (4,383) males counted in 1968 represents 63 and 37 percent, respectively, of the number counted in 1962.

Table 8.--Age composition of dead male seals, age 6 and older, Pribilof Islands, Alaska, 1965-68

Age	1965	1966	1967	1968
Years	----------Number----------			
6.....	--	--	5	6
7.....	5	6	1	5
8.....	17	19	10	8
9.....	24	31	23	13
10.....	37	29	7	15
11.....	29	33	17	17
12.....	15	18	14	17
13.....	20	19	20	15
14.....	5	5	6	5
15.....	4	5	2	8
16.....	--	3	--	4
17.....	--	4	3	2
18.....	--	--	1	--
10+[1].....	--	5	--	--
Total....	156	177	109	115

[1] Age could not be determined for five seals older than 10 years because their teeth were broken.

The rookeries on the Pribilof Islands were divided into sections containing about 100 class 3 males in July. The sections on St. Paul Island were established in 1966 from counts of class 3 males in 1965, whereas the sections on St. George Island were established in 1968 from the number of class 3 males counted in July of that year. Sections were not yet marked on St. George Island when the adult males were counted there in June 1968.

REPRODUCTIVE CONDITION OF FEMALE SEALS

Age and reproductive condition were determined for 2,473 females killed on St. Paul Island from 26 June to 16 August 1968 (table 9). The genital tracts of these females were examined for evidence of parturition in 1968, and ages were obtained from right upper canine teeth. Whole teeth from females age 6 and younger and sectioned teeth from females age 7 and older were used.

The pregnancy rates (table 9) do not represent the total population of females because the animals killed were taken from hauling grounds where the pregnancy rate is lower than on the rookeries. Data collected in most years from rookeries and hauling grounds cannot be separated, although comparisons of pregnancy rates of females from these areas are available for 1956-58 and 1968 (table 10).

Table 9.--Reproductive condition of female seals sampled from the kill, by age, St. Paul Island, 26 June to 16 August 1968

Age	Reproductive condition		Pregnancy rate
	Nonpost partum	Post partum	
Years	Number	Number	Percent
2	12	-	0
3	135	3	2
4	438	35	7
5	207	115	36
6	152	136	47
7	80	102	56
8	52	67	57
9	57	67	54
10	52	52	50
11	59	49	45
12	42	34	45
13	44	26	37
14	42	30	42
15	47	32	40
16	48	31	39
17	50	16	24
18	36	18	33
19	37	12	24
20	23	6	21
21	17	2	10
22	5	1	17
23	2	-	0
24	2	-	0
Total	1,639	834	
Ages 8-13	306	295	49

Table 10.--Pregnancy rates of female seals from hauling grounds and rookeries, age 8 and older, St. Paul Island

Year	Area	Females examined	Pregnancy rate[1/]
		Number	Percent
1956	Rookery	84	99
1957	Rookery	221	100
1958	Hauling ground	198	42
1968	Hauling ground	1,058	42

1/ Pregnancy rates are based on examinations of genital tracts for evidence of parturition during the summer the animals were killed.

LIVING PUPS WEIGHED

Data have been collected annually since 1957 on St. Paul Island to determine if the body weight of unmarked pups is related to the size of the kill of males of the year class at age 3. The results have been inconclusive in this respect, but do indicate that handling, and marking by tagging or by removing parts of flipper, retard the growth of pups. The relation of body weight of pups in autumn to the return of the year class at age 3 is discussed in the section on forecasts of the kill of males.

In 1968 we tested the variances and means (table 11) of the weights of unmarked pups from four rookeries. The variances for rookeries and sexes were common (P=0.41), and the frequency of weights appeared to be normally distributed. According to an analysis of variance test of rookeries and sexes, the rookery-sex interaction term was significant (P<0.05). The probable cause of this interaction was that on Morjovi Rookery males had the largest and females the smallest mean weight among the four rookeries. Although conclusions regarding rookeries and sexes are questionable because of the rookery-sex interaction, differences between rookeries are negligible when compared with differences between sexes (table 12).

Male pups averaged 9.6 kg. and females 8.3 kg. in 1968. These weights were within 0.1 kg. of the average weights for 1957-68 (table A-23).

We compared pup weight data obtained in 1968 by us on St. Paul Island and by Soviet scientists on Robben and Bering Islands. Weighing dates on Robben and St. Paul Islands were comparable, but the dates on Bering Island were later than for St. Paul Island (table 13). Untagged males on Robben Island

Table 11.--Variances in and means of the weights of living seal pups, St. Paul Island, 30 August 1968

Sex and rookery	Sample size	Variance	Mean
	Number		Kg.
Males			
Morjovi	100	3.5476	9.73
Reef	100	2.9949	9.60
Polovina	100	3.4794	9.48
Zapadni Reef	100	3.3783	9.45
All rookeries	400		9.56
Females			
Reef	100	2.1943	8.74
Zapadni Reef	100	2.7039	8.28
Polovina	100	2.2879	8.20
Morjovi	100	2.5036	7.92
All rookeries	400		8.28

Table 12.--Analysis of variance in the weights of living seal pups, St. Paul Island, 30 August 1968

Source	Degrees of freedom	Sums of squares	Mean squares
Rookeries	3	16.0484	(5.3495)
Sexes	1	328.3203	(328.3203)
Interaction	3	23.2610	1/ 7.7537
Error	792	2285.8925	2.8862
Total	799	2653.5222	

1/ P<0.05.

Table 13.--Means of the weights of living seal pups, Robben and Bering Islands, U.S.S.R., 1968

[Numbers of pups in parentheses]

Island	Date	Rookery	Males		Females	
			Tagged	Untagged	Tagged	Untagged
			Kg.	Kg.	Kg.	Kg.
Robben	2 Sept.	---	10.08 (38)	10.30 (63)	8.43 (30)	8.49 (70)
Bering	18 Sept.	Northern	10.17 (42)	11.57 (58)	9.77 (43)	10.18 (57)
Bering	23 Sept.	Northwestern	11.92 (38)	12.62 (62)	10.27 (24)	10.97 (76)

were 0.7 kg. heavier ($0.025<P<0.05$) than untagged males on St. Paul Island. Untagged females on Robben Island, however, were only 0.2 kg. heavier ($0.40<P<0.20$) than untagged females on St. Paul Island. Tagged pups on Robben Island weighed less than untagged pups, a fact that agrees with data collected on St. Paul Island in earlier years.

MARKING

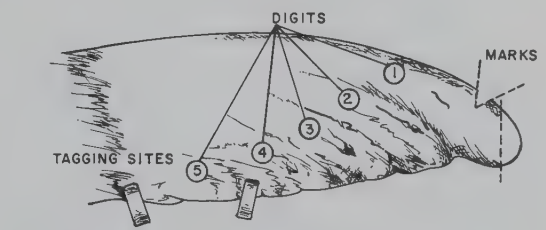
Recoveries of permanently marked seals provided data for making population estimates and for studying growth, mortality, and distribution of seals at sea. The application of marks in 1968 and the recovery of seals marked in previous years are discussed in this section. Most permanent marks are currently made by tagging and by removing parts of flippers.

APPLICATION OF MARKS

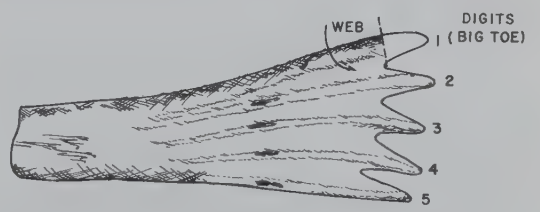
Monel cattle-ear tags have been used to mark seals on the Pribilof Islands since 1941. Table A-24 shows records of pups marked by tagging or by removing parts of flippers since 1959, and table A-25 gives similar data on male seals (yearlings and 2-year-olds) marked by tagging since 1961.

Pups

Single U-series tags were attached to 9,200 pups on St. Paul Island (table A-26) and to 2,475 pups on St. George Island (table A-27). Each tag was attached to the rear edge of a left front flipper at the hairline, and the tip of the same flipper was removed as a checkmark (fig. 9). A checkmark applied at the time of tagging enables us to identify the year of birth of any seals that lose their tags.



FRONT FLIPPER
TAGS CLINCHED AT THE HAIRLINE AND BETWEEN THE FOURTH AND THE FIFTH DIGIT.
MARKS MADE BY CUTTING A V-NOTCH AND REMOVING THE TIP.



HIND FLIPPER
MARK MADE BY REMOVING THE TIP OF THE FIRST DIGIT.

Figure 9.--Examples of mark locations that have been used on fur seals, Pribilof Islands, Alaska.

Yearling Male Seals

A total of 714 males were marked as yearlings on St. Paul Island in 1968. Two 1U-series

tags were attached to each of 686 males (table A-28) considered to be yearlings on the basis of body lengths, and to 28 known yearlings that had been marked as pups in 1967 and given one 1U-series tag (table A-29). Fourteen of the latter were born on islands owned by the U.S.S.R. Each tag was attached to a front flipper at the hairline (fig. 9). The mean body length (tip of nose to tip of tail) of all animals tagged was 93.4 cm.

Male Seals Age 2 Years

A total of 1,495 males known or believed to be 2 years old were marked with 2U-series tags. Soviet biologists had attached tags to 3 of these animals as pups in 1966, United States biologists had marked 29 with tags as pups and 54 by removing parts of flippers in 1966, and 1,409 had never been marked. All seals without tags were given two tags, and those with one tag were given an additional one. Each tag was attached to the front flipper at the hairline (fig. 9). We will determine the age of these seals at the time of tagging from their canine teeth when they are killed on the Pribilof Islands or elsewhere. In the past, some seals judged to be 2 years old were ages 1, 3, and 4.

Tables A-30 and A-31 give the number of seals tagged at "age 2" in 1968.

RECOVERIES OF MARKED SEALS

Data on marked animals recovered in 1968, an analysis of tag loss, the effect of the time of marking on survival, and the value of tags versus other marks are included in this section.

Marked Seals

Seals marked on the Pribilof Islands in previous years and recovered there in 1968 included 3,907 that had been given single tags or other marks as pups (table A-32) and 1,197 that had been given double tags at age 1 or older (table A-33). The information is incomplete for 228 of the animals that had been tagged at age 1 or older; the age of 40 could not be determined because the heads or flippers were separated from the carcasses during the skinning process, and 188 had lost both tags.

Marked seals killed from 26 June to 2 August were tabulated separately from those killed 3-16 August (table A-32) because the ages of 1,333 males taken during the latter period were not determined. In some of the analyses elsewhere in this report we use the data for these two periods separately.

Table A-34 and A-35 give the rookery of marking and location of recovery for seals given tags and checkmarks as pups in previous years and killed in 1968.

Thirty-nine seals tagged as pups by the Soviets were killed on the Pribilof Islands in 1968 (table A-36).

Tag Loss

Seals tagged as pups are also given a checkmark (fig. 9) so that the rate of tag loss can be determined. Rates of tag loss among males in ages 3, 4, and 5 are not greatly different from those among females of the same ages, though the comparison is based on a large kill of males of these ages and a relatively low kill of females. Females 4 years apart in age have the same identifying mark and cannot be accurately identified as to the year of birth if age 6 or older. We cannot, therefore, calculate a rate of tag loss for older females.

Table 14 shows the rates of tag loss among males tagged as pups with O- through S-series tags. The loss observed among males killed on St. George Island was less than that for males killed on St. Paul Island for all series, possibly because marked seals were overlooked when the carcasses were examined on the kill fields of St. George Island. On St. Paul Island, the carcasses are examined for tags and marks in the mink-food processing plant.

Seals tagged at age 1 or older are given two tags but no checkmark. The incidence of tag loss among these animals has been similar to that among seals tagged as pups, with the exception of 1T- and 2T-series tags attached to seals in 1967. For no apparent reason, the rate of loss for these tags was only about one-tenth that observed for tags of other series (table 15). Seals killed in the future will be examined carefully to determine what caused the low rate of loss for 1T- and 2T-series tags or whether the rate of loss is real.

If its rate is constant, tag loss should increase as the interval between tagging and recovery lengthens; however, we observed only slight increases for seals tagged as pups and at age 1 or older. Apparently, tag loss is highest soon after tagging and the probability of loss becomes less thereafter.

Time of Tagging

For many years, pups were tagged on the Pribilof Islands during the latter half of August, when they were about 2 months old and relatively small. We began to suspect, however, that the survival of tagged pups would be greater if they were tagged later in the season than August. Therefore, in 1963 we began a test of age at tagging as a factor in the survival of tagged pups.

Half of the pups tagged on St. Paul Island in 1963 and in 1964 were tagged in mid-August, and half were tagged in late September. The recovery rate has been significantly higher

Table 14. --Summary of tag loss for male seals tagged as pups, tag series O through S, Pribilof Islands, Alaska

Year and tag series	Age recovered	St. Paul Island				St. George Island			
		Tagged seals (a)	Lost-tag seals (b)	Total (a)+(b)	Ratio (b)/[(a)+(b)]	Tagged seals (a)	Lost-tag seals (b)	Total (a)+(b)	Ratio (b)/[(a)+(b)]
	Years	Number			Percent	Number			Percent
1962									
O	2	161	105	266	0.39	67	20	87	0.23
O	3	1,393	748	2,141	0.35	262	29	291	0.10
O	4	835	675	1,510	0.45	302	141	443	0.32
O	5	80	92	172	0.53	39	22	61	0.36
Total		2,469	1,620	4,089	0.40	670	212	882	0.24
1963									
P	2	53	57	110	0.52	5	3	8	0.38
P	3	1,038	491	1,529	0.32	244	72	316	0.23
P	4	490	313	803	0.39	166	48	214	0.22
P	5	53	24	77	0.31	27	8	35	0.23
Total		1,634	885	2,519	0.35	442	131	573	0.23
1964									
Q	2	121	60	181	0.33	10	21	31	0.68
Q	3	1,225	558	1,783	0.31	338	89	427	0.21
Q	4	582	272	854	0.32	160	36	196	0.18
Total		1,928	890	2,818	0.32	508	146	654	0.22
1965									
R[1/]	2	36	56	92	0.61	2	6	8	0.75
R	3	358	177	535	0.33	24	29	53	0.55
Total		394	233	627	0.37	26	35	61	0.57
1966									
S	2	35	22	57	0.39	6	10	16	0.62

1/ No R-series tags were applied to seals on St. George Island.

($P<0.001$) for tags applied to pups in September than for those applied in August (table 16). Because there is very little natural mortality of pups on land between mid-August and late September, we assume that the difference in recovery rate was caused by the difference in the age of the pups at the time of tagging. Consequently, we have scheduled all of the pup tagging on St. Paul Island in mid-September or later since 1966. We have continued to tag pups on St. George Island in August because transportation to the island is unavailable later.

Tags vs. Other Marks

Cattle-ear tags, when attached to pups, apparently cause an increase in mortality for that group of animals. The magnitude of the mortality, however, is unknown.

As it is nearly impossible to measure directly the effect of tagging on survival, other methods of marking believed to be less harmful were tried in 1965 to see if they would give comparable results. We used different marks on three groups of about equal numbers of pups. We attached a single cattle-ear tag to the left front flipper of each of 10,000 pups and cut a V-notch checkmark into the leading edge of the same flipper near the tip. We also marked 10,007 pups by cutting a V-notch into the leading edge of the right front flipper near the tip (RFV), and marked 10,080 by removing the tip of the first digit on the right hind flipper (RH1). Pups were given similar tags and marks in 1966. Examples of tag and mark locations are shown in figure 9.

Animals given tags and checkmarks in 1965 and seals given marks only in that year were recovered at age 2 in 1967 (Marine Mammal Biological Laboratory, 1970) and at age 3 in 1968 (table A-32). Of the 2-year-old males killed in 1967 from the three groups,

Table 15.--Summary[1] of tag loss for male seals tagged at age 1 or older, Pribilof Islands, Alaska

Tag series	Time elapsed since tagging	Both tags recovered	One tag lost	Incidence of tag loss
	Years	Number	Number	
2S.....	1	320	399	0.38
2S.....	2	45	63	0.41
Total.		365	462	0.39
2T.....	1	404	30	0.04
1R.....	1	35	21	0.23
1R.....	2	105	113	0.35
1R.....	3	31	35	0.36
Total.		171	169	0.33
1S.....	1	77	51	0.25
1S.....	2	132	150	0.36
Total.		209	201	0.32
1T.....	1	84	7	0.04

[1] Seals known to have lost two tags were excluded because there was no way to determine the tag series that had been applied.

returns were slightly higher among those with a tag and a checkmark (100) than those with an RH1 mark (72) or an RFV mark (94). In 1968, however, only 588 males were recovered with tags and checkmarks compared to 673 with RH1 marks and 709 with RFV marks. The small difference between the groups that received RH1 and RFV marks was not significant ($P=0.4$), but the difference between these two groups and the group given tags and checkmarks was significant ($P<0.005$).

Table 16.--Tag recoveries from male seals tagged as pups in August and September, St. Paul Island, 1963-64

Year class	Age recovered	Time of tagging: 12-21 August		Time of tagging: 20-25 September		Total
		Number	Percent	Number	Percent	Number
1963	2	13	28	34	72	47
	3	354	28	568	62	922
	4	180	37	312	63	492
Combined recoveries		547	37	914	63	1,461
1964	2	49	47	56	53	105
	3	527	47	596	53	1,123
	4	241	38	399	62	640
Combined recoveries		817	44	1,051	56	1,868

Of the seals marked in 1966, fewer 2-year-old males killed in 1968 had marks only than had tags and checkmarks (table A-32). This condition was also true for animals marked in 1965 and recovered in 1967.

We tentatively conclude that pups given marks have a higher survival rate than those given tags and checkmarks. The rate of recovery for males given a mark in 1965 and recovered at age 3 in 1968 was 1.17 times that of animals given a tag and checkmark. A higher recovery rate for males given a tag and checkmark and killed at age 2 in 1967 is attributed to unintentional selection for tagged animals during the kill. Most of the 2-year-old males are shorter than the minimum body length limit of 42 inches (107 cm.) set for killing. It is probable that among animals near this minimum limit, the people responsible for killing the seals select more tagged animals than those not visibly marked. If true, selection for tags by these people is undoubtedly subconscious and exaggerated because a seal with a tag attached to its flipper is more conspicuous than a seal with only a mark. There should be little or no selection for tagged animals among 3-year-old males because very few seals of this age are shorter than the minimum body length limit of 42 inches (107 cm.) set for killing. Selection for tagged animals is discussed further in the section on population estimates.

POPULATION ESTIMATES

We are currently evaluating each year class of seals by making estimates of its size at three stages of life: (1) Number of pups born; (2) number of pups that survive to age 1; and (3) number of the year class that survive to age ≥ 2. The estimates are presented in this section.

Because the age composition of 1,333 males killed after 2 August was not determined, only the recovery data collected before 3 August are used in calculations based also on the number of male seals killed.

NUMBER OF SEAL PUPS BORN

We make estimates of the number of pups born from: (1) tags and marks applied to pups of both sexes and recovered when the animals are taken in the kill; (2) shearing and sampling of pups; and (3) complete counts of living pups on some rookeries. The first method was used to estimate the size of year classes 1962-66 and the last two were used to estimate the number of pups born in 1968. In making estimates of the number of pups from tags and marks, we

Table 17.--Estimates of the seal pup population, year classes 1961-65, at time of marking from recoveries of marked female seals killed in 1967 and 1968, Pribilof Islands, Alaska

Year class	Age	Killed (C)	Marked (M)	Recovered (R)	Population estimate at time of marking[1] (N)
	Years		Number		
			1967		
1961	6	1,166	[2] 49,921	93	619,776
1962	5	1,552	[2] 49,908	169	455,933
1963	4	1,579	[2] 24,971	80	487,108
1964	3	935	[2] 24,991	66	349,142
			1968		
1962	6	1,581	[2] 49,908	137	572,145
1963	5	1,836	[2] 24,971	88	515,433
1964	4	2,630	[2] 24,991	126	517,748
1965	3	704	[2] 10,000	20	335,748
1965	3		[3] 10,080	15	444,194
1965	3		[4] 10,007	15	440,978
1965	3		[5] 30,087	50	415,922

[1] $\hat{N}=\frac{(C+1)(M+1)}{(R+1)}$

[2] Marked by tagging.

[3] Marked by removing the tip of the first digit on the right hind flipper.

[4] Marked by cutting a V-notch into the leading edge of the right front flipper.

[5] Marked seals of the 1965 year class combined.

combined the data from both islands, but separated the sexes (tables 17 and 18).

With the exception of the 1964 year class, estimates of the number of pups from tagged males recovered at age 2 have been less than estimates from recoveries at ages 3 and 4 (table 19). Among seals killed at age 2, therefore, more had tags than would be expected from the rate of recovery observed at ages 3 and 4. Estimates from recoveries of tagged 2-year-old males also varied considerably, probably because few animals of this age were taken.

Low estimates based on tagged males recovered at age 2 may be caused by unintentional selection for tagged animals, as described in the section Tags vs. Other Marks. Most 2-year-old males are less than the minimum body length limit of 42 inches (107 cm.) used as a guide to select animals for killing. Hence, a slight tendency to take tagged animals near the lower length limit and let untagged seals escape would account for the greater than expected number of tagged males among animals taken at age 2. A similar tendency when taking animals age 3 and older would have a negligible effect on the estimates because most seals of these ages are longer than the minimum limit of body length.

Table 18.--Estimates of the seal pup population, year classes 1963-66, at time of marking from recoveries of marked male seals killed 26 June to 2 August 1968, Pribilof Islands, Alaska

Year class	Age	Killed (C)	Marked (M)	Recovered (R)	Population estimate at time of marking[1] (N)
	Years		Number		
1963	5	1,935	[2] 24,971	112	427,839
1964	4	16,912	[2] 24,991	1,050	402,179
1965	3	22,978	[2] 10,000	588	390,175
1965	3		[3] 10,080	709	326,269
1965	3		[4] 10,007	673	341,207
1965	3		[5] 30,087	1,970	350,782
1966	2	2,040	[2] 12,499	73	344,764
1966	2		[6] 12,078	45	535,940

[1] $\hat{N}=\frac{(C+1)(M+1)}{(R+1)}$

[2] Marked by tagging.

[3] Marked by removing the tip of the first digit on the right hind flipper.

[4] Marked by cutting a V-notch into the leading edge of the right front flipper.

[5] Marked seals of the 1965 year class combined.

[6] Includes 9,578 seals marked by removing the tip of the third digit on the right hind flipper and 2,500 marked by removing the tip of the second digit on the left hind flipper.

Table 19.--Estimates of the seal pup population, year classes 1960-66, at time of tagging, from recoveries of marked male seals in ages 2 to 5, Pribilof Islands, Alaska

Year class[1]	Age			
	2	3	4	5
	Number			
1960	436,000	538,000	615,000	465,000
1961	323,000	495,000	479,000	232,663
1962	373,000	446,000	409,463	358,321
1963	301,000	420,804	380,786	427,839
1964	414,656	391,247	402,179	--
1965	[2] 291,210	[2] 390,175 [3] 333,769	--	--
1966	[2] 344,764 [3] 535,940	--	--	--

[1] Estimates for year classes 1960-64 from seals marked by tagging.

[2] Estimates from seals marked by tagging and by removing parts of flippers.

[3] Estimates from seals marked by removing parts of flippers.

Estimates of the 1965 year class show that the recovery rate for males given a mark was higher than that for males given a tag and

checkmark (see section on Tags vs. Other Marks). The opposite was true, however, for 2-year-old males of the 1965 year class recovered in 1967 and those of the 1966 year class killed in 1968.

Estimates of the pup population from marked females are higher than those from marked males but decrease at a similar rate by year class (tables 17 and 18). Estimates from recoveries of marked females vary considerably, according to age at recovery, probably because females that lose their tags cannot be identified accurately as to year class except for those in ages 2, 3, and 4. In addition, the number of females killed in each of these age groups is small. The estimates from recoveries of females are probably biased, so the data for the sexes were not combined to provide a pooled estimate. Generally, the use of combined data would produce estimates slightly greater than those based only on recoveries from males.

Because most or all of the mortality of pups on land occurs before marking, the number of dead pups counted was added to population estimates "at the time of marking" to obtain the total number of pups born for each year class. For reasons discussed previously, the most reliable estimates of the number of pups at the time of marking based on the recovery of marked males are believed to be at ages 3 and 4. According to the estimates, the total number of pups born has decreased each year since 1960 (table 20).

The pup population on four rookeries was estimated by shearing and sampling (Chapman and Johnson, 1968). Three rookeries were sampled four times, and one was sampled twice (table 21). The total of the mean estimate for the four rookeries was 27 percent lower than that obtained last in 1966 (table 22).

The number of pups counted on two rookeries in 1968 (table 23) changed little since 1966. The number on Morjovi Rookery was 4 percent less in 1968 than in 1966, and the number on Zapadni Reef Rookery was about 4 percent higher. According to estimates based on shearing and sampling, 17 percent fewer pups have

Table 20.--Estimates of the seal pup population, year classes 1960-65, at time of tagging from recoveries of marked male seals in ages 3 and 4, and the count of dead pups, Pribilof Islands, Alaska

Year class[1]	Estimate of pups at time of tagging	Count of dead pups	Total pups born
	Number	Number	Number
1960	568,000	75,000	643,000
1961	489,000	71,000	560,000
1962	430,000	54,000	484,000
1963	407,000	39,000	446,000
1964	395,000	25,000	420,000
1965	[2] 351,000	46,000	397,000

[1] Estimates for year classes 1960-64 were from seals marked by tagging.

[2] Estimates from recoveries of 3-year-old males marked by tagging and by removing parts of flippers.

Table 21.--Estimates of the seal pup population, year class 1968, from shearing and sampling on selected rookeries, St. Paul Island

Rookery	Pups sheared	First sampling period, 17 August				Second sampling period, 20-22 August			
		Samples	Counted		Estimated pup population at time of shearing $(\hat{N})$[1]	Samples	Counted		Estimated pup population at time of shearing $(\hat{N})$[1]
			Sheared	Total			Sheared	Total	
	Number								
First count									
Morjovi.....	2,529	106	380	2,650	17,636	64	270	1,600	14,987
Reef.....	4,216	125	547	3,125	24,086	75	324	1,872	24,359
Vostochni[2]...	5,581	--	--	--	--	115	464	2,875	34,581
Zapadni Reef.	721	19	78	475	4,391	17	68	425	4,506
Second count									
Morjovi.....	2,529	101	393	2,525	16,249	56	238	1,400	14,876
Reef.....	4,216	90	352	2,250	26,949	60	264	1,500	23,955
Vostochni[2]...	5,581	--	--	--	--	104	454	2,600	31,962
Zapadni Reef.	721	15	64	375	4,225	13	46	325	5,094

[1] $\hat{N} = \frac{MC}{R}$; where $\hat{N}$=estimates of the pup population at time of shearing; M=number of pups sheared; C=number of pups counted during sampling; and R=number of sheared pups counted during sampling.

[2] Pups were not sampled on Vostochni Rookery 17 August.

Table 22.--Mean estimates of the seal pup population, year classes 1966 and 1968, from shearing and sampling on selected rookeries, St. Paul Island

Rookery	Mean estimate		Decrease
	1966	1968	
	Number	Number	Percent
Morjovi	19,166	15,937	17
Reef	34,918	24,837	29
Vostochni	48,834	33,276	32
Zapadni Reef	4,942	4,554	8
Total	107,860	78,604	27

been born on Morjovi and 8 percent fewer on Zapadni Reef Rookeries since 1966.

Beginning in 1963 the annual kill of females has been adjusted to maintain a constant level of pup production; however, the production of pups may have descreased slightly since then. Recent estimates of the pup population from recoveries of marked seals have declined steadily and have not varied as they did for year classes 1955-59. The estimates may be slightly inflated by tag-caused mortality and are, in fact, higher than estimates from shearing and sampling in the summer of birth. Confidence limits have not been calculated because we believe that the estimates are biased and, therefore, the limits would not reflect the true confidence level. Perhaps we can accept the estimate of the number of pups born from recoveries of animals given tags or other marks as the upper limit and the estimate based on shearing and sampling as the lower limit, and assume that the actual number is between the two estimates. For example, the limits for the 1965 year class are 400,000 and 350,000, rounded to the nearest 10,000. The number of pups born in 1968 is probably within this range also.

NUMBER OF YEARLING MALE SEALS

Recoveries of yearling seals tagged in autumn have been used to estimate the size of a year class at age 1, and 1968 was the first year in which sufficient data from the recovery of males tagged at age 2 or older became available for evaluating survival beyond age 1.

The survival to age 1 of seals born in 1964-66 was estimated from tags recovered from males selected by body length and tagged as yearlings in 1965-67. The true age of each seal recovered in the kill was determined from a canine tooth. The age composition was then used to estimate the actual number of yearlings that were tagged. For example, of 873 males tagged as yearlings in 1965, 64 were known yearlings (tagged as pups) from the 1964 year class and 809 were considered to be yearlings on the basis of their length (see section on yearling tagging). Of 294 seals selected as yearlings and later recovered, 21 were 2-year-olds (1963 year class) and 273 were yearlings (1964 year class) when tagged. Therefore, the estimated number of males that were actually yearlings from the 1964 year class when tagged in 1965 was 815; that is, 64+(273/294)809.

The number of tagged seals recovered was adjusted to include animals of unknown age and those that had lost both tags (table 24). Animals of unknown age that could be identified as belonging to a given tag series were allotted by age according to the observed age of animals selected for tagging and recovered in the kill. Seals that lost both tags and could not be identified as to the year tagged were allotted according to the number of tags recovered for

Table 23.--Complete counts of living seal pups on selected rookeries in early August, St. Paul Island, 1963-68

Rookery	1963	1964	1965	1966	1967	1968
	Number					
Little Polovina	7,230	7,180	7,314	7,071	6,030	---
Morjovi[1/]	---	17,530	18,384	17,388	---	16,781
Zapadni Reef	---	5,700	5,383	5,729	4,665	5,916
Lukanin	---	---	---	----	3,244	---
Kitovi	---	---	---	---	10,307	---

[1/] The pups on a small rookery south of Sea Lion Neck were not counted.

Table 24.--Estimates of the number of yearling male seals, year classes 1964-66, from recoveries of tagged male seals, Pribilof Islands, Alaska

Year class and tag series	Year when killed	Age when killed	Killed (C)	Tagged[1/] (M)	Recovered[2/] (R)	Estimate of yearling males $\hat{N}=(MC)/R$
		Years	Number			
1964				815		
1R	1966	2	3,533		40	71,985
1R	1967	3	34,613		274	102,954
1R	1968	4	16,912		76	181,359
1R	Pooled		55,058		390	115,057
1965				1,277		
1S	1967	2	2,940		108	34,763
1S	1968	3	22,978		312	94,048
1S	Pooled		25,918		420	78,803
1966				709		
1T	1968	2	2,040		75	19,285

1/ Number of tags applied were adjusted according to the error in age determination at time of tagging as observed when tagged animals were recovered in the kill. Data for the 1965 year class were used to adjust the number of tags applied to the 1966 year class. The number for 1965 was further adjusted by dividing 1.08 to account for recoveries expected in 1969. This adjustment was based on the average ratio of error in determining age for 3-year-olds through the kill, and all recoveries for the 1961, 1962, and 1964 year classes.

2/ The adjusted total includes animals recovered but for which data are missing, those of unknown age, and double-tag loss. The proportion in each age within a tag series was used to allocate animals of unknown age that could be identified as belonging to a given tag series; seals that lost both tags and could not be identified as to the year tagged were allocated according to the number of tags recovered for each age and tag series (see example in section of Number of Yearling Male Seals).

each age and tag series. Although this method of allocating the recoveries for which information is missing is questionable, there is some advantage in including the data. We hope to devise a better method when seals with tags of the series involved have been killed at ages through 5 years.

Estimates of the number of yearling males vary considerably from one year class to another and between years within a year class. Estimates of the number of yearling males from all recoveries for year classes 1961, 1962, 1964, and 1965 were 82,000, 79,000, 115,000, and 80,000 respectively. The estimate for each of these year classes from recoveries at age 2 was much lower than estimates from recoveries at other ages, a condition that could have been caused by selection for tagged animals during the kill. If the estimates from recoveries at age 3 are correct, we recovered more than twice the expected number of tagged animals at age 2 from year classes 1964 and 1965, and also from year classes 1961 and 1962 (Marine Mammal Biological Laboratory, 1970).

NUMBER OF MALE SEALS AGE 2 YEARS

Males known or believed to be 2 years old were tagged in 1966, 1967, and 1968 (age was subsequently determined from the canine teeth of these seals--some of the animals were actually ages 1, 3, and 4 when tagged). Seals tagged in 1966 have now been harvested through two seasons, and few additional recoveries are expected. Age was determined from canine teeth for all seals from this group as they appeared in the kill, except those from which the head or flippers were torn from the carcass during the skinning process. The age distribution of the tagged animals was then used to

Table 25.--Summary of male seals known or believed to be 2 years old when tagged in 1966, and recovered in 1967 and 1968, St. Paul Island

Age	Tagged (2S-series)		Recovered, 1967 and 1968				Adjusted totals[3]	
	Known age[1]	Selected[2]	Known age		Selected			
			1967	1968	1967	1968	1967	1968
Years	----------	----------	----------	Number	----------	----------	----------	----------
1	-	14	-	-	8	-	12	-
2	56	1,068	28	5	519	91	706	120
3	9	329	6	-	167	11	223	13
4	4	-	1	-	-	-	1	-
Unknown			-	-	36	4/5	-	-
Total	69	1,411						

1/ Age known from mark applied as a pup.
2/ Age unknown at time of tagging but later determined from canine teeth of tagged animals recovered in the kill.
3/ Includes animals of unknown ages and seals with both tags lost (see discussion in section Number of yearling male seals).
4/ Excludes one male recovered during the kill of females.

Table 26.--Estimates of the number of 2- and 3-year-old male seals, year classes 1963-64, from recoveries of male seals known or believed to be 2 years old when tagged, St. Paul Island

Year class	Age when tagged[1]	Tagged (2S-series) (M)	Killed (C)	Recovered[2] (R)	Population estimate[3] N=(MC)/R
	Years	----------	Number	----------	----------
			1967 recoveries		
1963	3	338	15,523	223	23,528
1964	2	1,124	34,613	706	55,106
			1968 recoveries		
1963	3	338	1,935	13	50,310
1964	2	1,124	16,912	120	158,409
			Combined recoveries		
1963	3	338	17,458	236	25,003
1964	2	1,124	51,525	826	70,114

1/ Some seals judged to be 2 years old were age 3.
2/ Only tags recovered from 26 June through 5 August 1967 and 26 June through 2 August 1968 are included. The number of recoveries were adjusted to include animals for which data were missing (see footnote 2, table 24).
3/ Tags were applied after the kill in 1966, so the estimate applies to that time.

estimate the number of tags applied to each age class at the time of tagging. Table 25 summarizes the number of tags attached to seals on St. Paul Island in 1966 and recovered on the Pribilof Islands in 1967 and 1968.

The number of males tagged at ages 2 and 3 in 1966 can be used for making population estimates. On the basis of recoveries of tags in 1967 and 1968 (table 26), 25,000 3-year-old males from the 1963 year class and 70,000 2-year-old males from the 1964 year class were still living after the kill in 1966. The estimates for both year classes from recoveries in 1968 are much higher than estimates from recoveries in 1967. Possible causes for the discrepancy in the estimates between years for a given year class are that some of the animals that lose both tags are not recognized and the number of animals with both tags lost would be greater 2 years after tagging than 1 year later.

The estimates of 25,000 males age 3 and 70,000 males age 2 remaining after the kill in 1966 seem reasonable. A more critical appraisal of the results will be possible when additional data become available.

FORECAST OF THE KILL OF MALE SEALS

Forecasts of the number of male seals in the kill have been made each year since 1959. The accuracy of the various prediction methods was reviewed in 1966 (Marine Mammal Biological Laboratory, 1969), but no quantitative comparisons were made. Quantitative comparisons for past data, forecasts of the kill of 3- and 4-year-old males for St. Paul Island in 1969, and forecasts of the kill of males 2 to 5 years old for the Pribilof Islands in 1969 are discussed in this section.

QUANTITATIVE COMPARISONS FOR 3- AND 4-YEAR-OLD MALE SEALS

Table 27 gives the results of five methods of forecasting the kill of 4-year-old males.

Table 27.--Comparisons of forecast[1] of kill of 4-year-old male seals, by method, St. Paul Island, 1965-68

Method	Year			
	1965	1966	1967	1968
	Thousands			
Regression on kill of 3-year-olds and mean round	14.3(+)	10.2(-)	14.1(+)	10.5(-)
Regression on mean air temperature	13.5(+)	19.7(++)	20.0(++)	4.3(--)
Regression on pup weight	--	--	--	9.2(-)
Regression on the number of pups born and count of dead pups	--	--	--	17.8(+)
Forecast derived from yearling estimate	12.0	12.4	Not available	[2] 25.1(++)
Combined estimate	13.0	14.0	14.3	13.0
Actual kill[3]	12.0	12.1	11.8	13.3

1/ Erred positively by a moderate (+) or large (++) amount or negatively by a moderate (-) or a large (--) amount.

2/ The yearling estimate used was incorrect because no allowance was made for double tag-lost recoveries. If the tag-lost recoveries were considered, the forecast would have been 12.0, which like the other forecasts derived from yearling estimates is very accurate.

3/ The season for killing males ended 9 August in 1965, 5 August in 1966 and 1967, and 2 August in 1968.

This comparison is made only for the past 4 years, a period when forecasts have been most successful. To go back further is of little use, because methods have changed as new data became available and old data became unsatisfactory.

It is possible to calculate an empirical standard error for the three methods that have several comparisons, that is, the square root of the average of the squares of deviations of forecast from actual value. Because we are evaluating the method, it is appropriate to use the figure (12.0) for the 1968 forecast based on the yearling estimate. The standard errors are:

Regression on the kill at age 3 and mean date	2.6 thousand
Regression on temperature	7.9 thousand
Based on yearling estimate	0.3 thousand

The first two standard errors are in agreement with the theoretical values noted in recent forecasts; the last is much smaller than suggested by theory. Two points may be noted. First, because the standard error of 0.3 thousand is based on only three comparisons, sampling error may be large, and an extension of the killing season in 1965 and a reduction in 1968 reduced the error in this forecast. Second, even if we allowed for departures from routine, the standard error of 0.3 thousand as derived from the empirical comparisons would be increased to only 1.3 thousand.

Table 28 shows a comparison of recent forecasts with the actual kill, by method, for 3-year-olds.

FORECAST OF THE KILL OF 4-YEAR-OLD MALE SEALS

Four methods used to forecast the kill of 4-year-old males are: (1) Regression of the kill of 4-year-old male seals on the kill of 3-year-old male seals and the mean round of the kill of 3-year-old male seals; (2) regression of the kill at ages 3 and 4 on mean air temperature; (3) regression of the kill at ages 3 and 4 on the mean weight of pups and the count of dead pups; and (4) an estimate of the number of yearling male seals.

Regression of the Kill of 4-year-old Male Seals on the Kill of 3-Year-Old Male Seals and the Mean Round of the Kill of 3-Year-Old Male Seals

This regression uses data from the 1953 and subsequent year classes; 5 August was considered the end of the male kill, and adjustments were made where necessary. For example, 18,706 3-year-olds and 13,279 4-year-olds were killed in 1968; an additional 2,000 3-year-olds and 680 4-year-olds would have been taken had the kill been extended from 2 to 5 August, the "standard" termination date of recent years. These estimates are based on an average daily kill of 981 3-year-old

Table 28.--Comparisons of forecast[1/] of kill of 3-year-old male seals, by method, St. Paul Island, 1965-68

Method	Year			
	1965	1966	1967	1968
	Thousands			
Regression on mean air temperature	24.0(++)	31.0(++)	21.2(--)	18.9
Regression on pup weight	--	19.7(--)	24.7(-)	26.5(++)
Regression on the count of dead pups	--	--	--	19.2(+)
Forecast derived from yearling estimate	28.6(++)	--	--	21.7(+)
Actual kill[2/]	19.0	25.5	27.0	18.7

1/ Erred positively by a moderate (+) or a large (++) amount or negatively by a moderate (-) or a large (--) amount.

2/ The season for killing males ended 9 August in 1965, 5 August in 1966 and 1967, and 2 August in 1968.

Table 29.--Data for regression of the kill of 4-year-old male seals based on the kill of 3-year-old male seals and mean round of the kill of 3-year-old male seals, year classes 1953-64, St. Paul Island

Year class	Kill of 3-year-old males before 5 August (X_1)	Mean round of the kill of 3-year-old males (X_2)	Adjusted kill of 4-year-old males before 5 August (Y)
	Thousands		Thousands
1953	31.7	3.5	13.5
1954	19.8	3.4	8.7
1955	31.2	3.2	8.1
1956	11.7	3.3	1.9
1957	21.6	4.0	16.2
1958	38.9	3.8	21.0
1959	25.1	3.6	14.9
1960	14.0	3.7	10.8
1961	22.2	3.8	11.3
1962	15.2	4.0	15.1
1963	25.5	3.7	11.8
1964	27.0	3.5	14.0

males and 342 4-year-old males from 29 July to 3 August 1968. The reduction was of 2 killing days because Sunday (4 August) was not a working day. Table 29 shows the basic data for this regression, as extended with new data from the 1964 year class.

The method of adjustment has been discussed in previous reports and is summarized in the footnote to table 19 in the 1967 report (Marine Mammal Biological Laboratory, 1970). The resulting regression equation is:

$$Y = -47.42 + 0.39X_1 + 13.95X_2$$

where: Y, X_1, and X_2 are as indicated in table 29.

For the 1965 year class, X_1 (kill of 3-year-old males before 5 August) as adjusted is 20.7 thousand and X_2 (mean round of kill of 3-year-old males) is 4.07. As in the basic data, the mean round (X_2) of 4.07 was converted from the mean date of the kill (21.36 July). The unadjusted estimate of the kill of 4-year-old males in 1969 is 17.4 thousand. This estimate has a standard error of 2.0 thousand. The actual forecast must consider the 3-year-olds spared from 3 to 5 August and those taken in the postseason kill. Maximum and minimum numbers of seals that might be added to the kill of 4-year-old males in 1969 because of these factors are 1,300 and 400, respectively. Adding the average of these figures to the unadjusted forecast yields a final forecast by this method of 18.2 thousand.

Table 30.--The observed kill of 3- and 4-year-old male seals, mean air temperature, mean weight of living seal pups, and count of dead pups, year classes 1950-64, St. Paul Island

Year class	Temperature (in tenths of a degree above 32°) (T)	Mean weight of unmarked pups in autumn (W)	Count of dead pups (D)	Observed kill at ages 3 and 4 1/ (K)
	°F.	Kg.	Thousands	Thousands
1950	35	-	56	56
1951	36	-	2/ 74	50
1952	37	-	2/ 45	62
1953	16	-	82	47
1954	10	-	101	29
1955	17	-	79	38
1956	1	-	104	13
1957	23	8.7	65	40
1958	34	11.4	33	63
1959	33	9.4	42	41
1960	26	9.8	66	25
1961	18	8.5	61	35
1962	21	9.2	48	31
1963	28	8.9	34	37
1964	15	9.1	23	41

1/ Adjustments were made for year when the kill did not end 5 August.
2/ Estimated.

Regression of the Kill at Ages 3 and 4 on Mean Air Temperature

Table 30 shows the basic data for this regression. The temperature regression is:

$$Y = 17.61 + 0.98T \quad (r^2 = 0.59,\ r = 0.77)$$

where: T is the mean air temperature in tenths of a degree above 32°.

Unfortunately, the highly significant relation found several years ago between the annual mean air temperature for the 12 months ending 30 June of the year of birth of the year class and year-class returns continues to deteriorate. The validity of this relation has always been dubious because the casual mechanism is unclear. The estimated values of Y as determined from the regression equation are in table 31 for year classes 1957-64.

Table 31.--Comparison of estimated and actual kill of 3- and 4-year-old male seals, year classes 1957-64, St. Paul Island

Year class	Estimated kill 1/	Actual kill of 3- and 4-year-old male seals	Difference
	Thousands		
1957	40	40	0
1958	51	63	-12
1959	50	41	9
1960	43	25	18
1961	35	35	0
1962	38	31	7
1963	45	37	8
1964	32	41	-9

1/ Estimated from the air temperature regression Y = 17.61+0.98T.

Although the average error for 1957-64 is about 2.7 thousand, fluctuations have been wide. Thus, this forecast method must be evaluated carefully in the future. Setting aside these reservations, the forecast for the 1965 year class is found by setting T = 12.

The kill at age 3 and 4 in 1965 was 29.4 thousand. Because the kill of 3-year-olds in 1968 was 18.7 thousand (plus some fraction of the postseason kill), this method yields a remaining estimated balance of about 10 thousand. The standard error is 9.7 thousand.

Regression of the Kill at Ages 3 and 4 on the Mean Weight of Living Seal Pups and the Count of Dead Seal Pups

The count of dead pups provided a forecast that was too high, and the regression on mean weight of living pups provided one that was too low. It seemed appropriate, therefore, to consider a multiple regression using both variables. Because pups were first weighed in 1957, that year was used as a starting point. The data for the regression are in table 30. The resulting multiple regression equation is

$$K = -12.14 - 0.25D + 6.73W \quad (R^2 = 0.56);$$

K, D, and W are defined in table 30.

None of the F ratios shown in table 32 in an analysis of the two variables are significant; the variable D (count of dead pups) in particular seems to have little estimation value. The forecast procedure is retained, however, because its standard error is large and will receive little weight. The total kill in 1968 of the 1965 year class was estimated to be 41.5 thousand. The balance to be taken at age 4 is about 22.0 thousand. The standard error of this estimate is 9.3 thousand.

Table 32.--Analysis of variance in a regression of the total kill of 3- and 4-year-old male seals (K) on count of dead seal pups (D) and mean weight of living seal pups (W)

Source	Sums of squares	Degrees of freedom	Mean square	F ratio
Due to regression of K on D and W	488.73	2	244.36	3.25
Due to regression of K on D alone	238.61	1	238.61	3.17
Due to regression of K on W alone	104.90	1	104.90	1.39
Error	376.15	5	75.23	

Estimate of the Kill Based on an Estimate of the Yearling Male Seal Population

Table 33 shows the estimates of the yearling population surviving from the 1961, 1962, and 1964 year classes on the basis of recoveries

Table 33.--Estimated number of yearling male seals, and the ratio of the kill at ages 3 and 4 on St. Paul Island to the number of yearling male seals, year classes 1961, 1962, and 1964

Year class	Yearling estimate 1/ (a)	Combined kill at age 3 and 4 St. Paul Island (b)	Ratio $(\frac{b}{a} \times 100)$
	Thousands	Thousands	Percent
1961	76.4	34.5	45.2
1962	85.9	31.1	36.2
1964	103.0	40.3	39.1
Mean			40.2

1/ Based on recoveries at age 3; estimates from recoveries at age 2 have been biased.

of tags from 3-year-olds, the kill on St. Paul Island from these year classes at ages 3 and 4, and the ratio expressed as a percentage.

From table 24 the estimate of the yearling population of the 1965 year class is 94.0 thousand, of which 40.2 percent is 37.8 thousand. Therefore, an implied balance to be taken from the 1965 year class at age 4 is 18.3 thousand. The standard error of the forecast is 4.8 thousand.

Combined Estimates of the Kill of 4-Year-Old Male Seals on St. Paul Island

The several estimates and their standard errors are:

Method	Estimate	Standard error
	Thousands	Thousands
Regression on kill at age 3 and mean round of kill at age 3	18.5	2.0
Regression on mean air temperature . . .	9.9	9.7
Regression on mean weight of pups and count of dead pups . .	22.0	9.5
Estimate derived from yearling population	18.3	4.8
Weighted average	18.3	1.8

The analysis in table 27 might suggest that more weight should be given to the estimate derived from the yearling estimate. Because the combined average estimate is identical with this yearling-derived estimate, however, such increased weighting would have no effect for 1969.

FORECAST OF THE KILL OF 3-YEAR-OLD MALE SEALS

Two methods used to forecast the kill of 3-year-old males are discussed in this section: (1) Two regressions, one based on air temperatures and another on mean weights of living pups and counts of dead pups, and (2) estimated number of yearling males.

Regression of Kill at Ages 3 and 4 on Air Temperature, Mean Weights of Living Seal Pups, and Counts of Dead Seal Pups

All regressions except the first calculated in the previous section are also useful for making estimates of the kill of 3-year-old males expected in 1969. Estimates of the kill of 3-year-old males in 1969 are derived by multiplying the combined estimate of the kill of 3- and 4-year-olds (K) by 0.67 (the ratio of the kill of 3-year-old males to the kill of 3- plus 4-year-old males), a factor that has been used for several years. For the 1961-64 year classes the ratio was 0.66, almost identical to the long-term ratio. Use of this most recent ratio would alter the forecast only slightly. The regressions and the estimates are:

1. Temperature regression $K = 17.61 + 0.98T$
   For the 1966 year class $T = 29$, $\hat{K} = 46.0$ thousand with a standard error of 9.5 thousand, and for 1969 the kill of males at age 3 is estimated as 30.8 thousand.
2. Pup weight and dead pup count regression $K = -12.14 - 0.25D + 6.73W$
   For the 1966 year class $D = 22.5$, $W = 9.6$, $\hat{K} = 46.8$ with a standard error of 11.4 thousand, and for 1969 the kill of males at age 3 is estimated at 31.4 thousand.

Forecast of the Kill at Age 3 Based on an Estimate of the Yearling Male Seal Population

Table 24 gives 19,285 as the estimated number of yearlings surviving from the 1966 year class. This estimate of the yearling population is the lowest to date, though all estimates based on recoveries at age 2 have been biased downward. It is still not clear why this bias exists, unless tagged seals are selected during the commercial kill. The extent to which such selection might vary from year to year is unknown, though evidence to date suggests considerable variation. To obtain a valid procedure for forecasting it is necessary to adjust the estimate obtained at age 2, which can be done with a direct correction factor derived empirically from the various final estimates of earlier year classes. An alternative indirect but simpler procedure is to calculate a regression of the kill at age 3 against the estimate of the yearling population obtained from tag recoveries at age 2. The data are in table 34 and the regression is:

$$K_3 = 15.3 + 0.15E \quad (r^2 = 0.65)$$

For the 1966 year class $E = 19.3$ and hence $\hat{K}_3 = 18.3$ with a standard error of 6.1 (all in thousands).

Although the yearling population estimate and the resulting estimated kill of 3-year-old males seem low, it is difficult to discard the two entirely because the estimate derived from yearlings has to date been the best for forecasting the kill of 4-year-old males. Moreover, the estimate, although low, is reasonable because the major variable is apparently survival during the first 2 years. All other methods

Table 34.--Estimated number of yearling male seals, year classes 1961, 1962, 1964, and 1965, from tag recoveries at age 2, and the kill of 3-year-old male seals, St. Paul Island

Year class	Estimate based on recoveries at age 2 (E)	Kill of 3-year-olds (K_3)
	Thousands	Thousands
1961	27.1	22.5
1962	33.8	19.0
1964	72.0	27.0
1965	34.8	18.7

attempt to estimate survival indirectly, but the forecast based on the yearling estimate reflects a direct estimate.

Combined Estimates of the Kill of 3-Year-Old Male Seals on St. Paul Island

The estimates and their standard errors are:

Method	Estimate Thousands	Standard error Thousands
Air temperature regression....	30.9	9.5
Pup weight and dead-pup count regression.....	31.4	11.4
Yearling estimate.	18.3	6.1
Weighted average	23.6	4.7

ESTIMATES OF THE TOTAL KILL OF MALE SEALS IN 1969

Table 35 shows the forecast of the total kill of males for the Pribilof Islands. The estimated kill at ages 2 and 5 is the average of recent years. The extrapolation to St. George Island is based on the assumption that the population of seals there is about 20 percent of the total. Table 36 compares the forecast for 1968 with the actual number killed in that year.

Table 35.--Forecast of the kill of male seals in 1969, by age, Pribilof Islands, Alaska

Island	Age			Total
	2 and 5	3	4	
	Number			
St. Paul	3,300	23,600	18,300	45,200
St. George	900	5,900	4,600	11,400
Total	4,200	29,500	22,900	56,600

Table 36.--Forecasted and actual kill of male seals, Pribilof Islands, Alaska, 1968

Island	Age			Total
	2 and 5	3	4	
	Number			
St. Paul				
Actual	3,215	18,706	13,279	35,200
Forecast	3,500	22,000	13,000	38,500
St. George				
Actual	839	4,443	3,680	8,962
Forecast	1,000	6,000	4,000	11,000
Combined				
Actual	4,054	23,149	16,959	44,162
Forecast	4,500	28,000	17,000	49,500

The forecast error for 1968 was greater than that for 1966 and 1967. The error was about 1,000 for St. Paul Island and about 2,000 for St. George Island if allowance is made for advancing the termination date to 2 August. We hope the forecast error can be kept to this order of magnitude, though many variables in differential survival and in estimated errors are still poorly understood.

SPECIAL STUDIES

This section includes studies of fur seal biology that are carried on in addition to continuing studies described in the main body of this report.

ACTIVITY OF YOUNG MALE SEALS ON LAND

Studies of the activity of young males while they are on hauling grounds will provide information useful for harvesting the population. In 1968, some young males were tagged and radio transmitters were attached to others for studies of behavior.

Tagging

Between 24 June and 18 July, 334 young males in ages 2 to 5 were double tagged St. Paul Island (table 37). Among 226 tagged males taken in the commercial kill by 13 August, 2, 55, 42, and 1 percent were in ages 2, 3, 4, and 5, respectively. Four were killed on St. George Island, and 222 were taken on St. Paul Island. One seal tagged on 24 June was killed on Southeastern Rookery, Medny Island, U.S.S.R., in 1968, but the exact date of recovery is not known. Presumably, some of the survivors will be killed on the Pribilof Islands in 1969 and 1970.

Table 37. --Number of days between tagging and recovery of tags applied to male seals, St. Paul Island, 24 June to 18 July 1968

Date of tagging	Hauling ground of tagging[1]	Tag numbers[2] (X-series)	Effective tags	Days to recovery						Total tags recovered
				1-7	8-14	15-21	22-28	29-35	36-43	
			Number	Number						Number
24 June	REEF	901-950	50	27	3	2	6	4	-	[3]42
24 June	ZAP	951-1000	50	16	8	1	10	5	2	42
25 June	NEP(west)	851-900	50	30	2	-	5	1	5	43
25 June	ZAP PT	776-800	25	13	-	2	1	-	1	17
25 June	ARD	826-841	16	5	1	1	2	1	-	10
10 July	NEP(east)	701-750	50	14	3	1	3	-	-	21
11 July	TZR	651-700	50	21	1	3	3	-	-	28
18 July	REEF	1001-1042 and 1051-1094	43	22	-	1	-	-	-	23
Total			334	148	18	11	30	11	8	226
Percentage of effective tags				44.3	5.4	3.3	9.0	3.3	2.4	67.7

1/ REEF=Reef; ZAP=Zapadni; NEP(west)=west side of Northeast Point; ZAP PT=Zapadni Point; ARD=Ardiguen; NEP(east)=east side of Northeast Point; TZR=Tolstoi-Zapadni Reef. Zapadni Point and Ardiguen are inaccessible areas where seals are not driven and killed.

2/ Seals were double tagged with paired numbers (651 and 651 on first seal, etc.), except for 1001-1094 which were double tagged with successive numbers (1001 and 1002 on first seal, etc.).

3/ Does not include one seal tagged on REEF on 24 June and recovered in 1968 (date unknown) on Southeastern Rookery, Medny Island, U.S.S.R.

Most of the hauling grounds on St. Paul Island are accessible, and seals are regularly driven from them for killing. Hauling grounds near Ardiguen Rookery and at Zapadni Point are exceptions. Seals on these areas are not driven for killing because of overhanging cliffs and are taken only if they stray to an accessible hauling ground. This condition was reflected in relatively low recovery rates of 62 percent for seals tagged near Ardiguen Rookery and 68 percent at Zapadni Point.

Zapadni, Reef, Northeast Point, and Tolstoi-Zapadni Reef are examples of rookeries with accessible hauling grounds close by that are driven regularly during the killing season. As expected, the recovery rates for seals tagged in June on Zapadni, Reef, and Northeast Point were much higher than the rates for seals tagged near Ardiguen Rookery and at Zapadni Point. In addition, the recovery rates for seals tagged in June differed from those tagged in July. An overall recovery rate of 85 percent (range 84-86) for seals tagged in June on the hauling grounds of Zapadni, Reef, and the west side of Northeast Point was higher than the rate (50 percent) for seals tagged in July on the hauling grounds of Reef, Tolstoi-Zapadni Reef, and the east side of Northeast Point (table 38). On the basis of a standard recovery interval of 15 days (the interval between tagging on 18 July and the end of the male kill on 2 August), 57 percent of the seals tagged in June and 43 percent of the seals tagged in July were recovered. In 1968, therefore, a larger proportion of the males found on land and tagged in June remained available for killing compared to those found on land and tagged in July.

The interval between tagging and recovery ranged from 1 to 43 days for seals killed in 1968 (table 37); each of the 226 seals recaptured had retained both tags. The four animals killed on St. George Island were taken 20 to 26 days after tagging. The largest proportion of recoveries occurred soon after tagging. Fifty percent of the seals that were tagged

Table 38.--Recoveries in 1968 of male seals tagged on St. Paul Island, 24 June to 18 July 1968 according to hauling ground

Date of tagging	Hauling ground of tagging[1/]	Effective tags (X-series)	Hauling ground of recovery[1/]									Total	
			NEP(west)	NEP(east)	ZAP	TZR	REEF	L-K	POL	ZAP(SG)	NOR		
		Number	Number									Number	Percent
24 June	ZAP	50	-	5	16	15	3	-	1	-	2	42	82.0
24 June	REEF	50	-	1	-	1	35	3	1	-	1	[2/]42	84.0
25 June	NEP(west)	50	30	11	-	-	1	1	-	-	-	43	86.0
25 June	ZAP PT	25	-	-	9	6	1	1	-	-	-	17	68.0
25 June	ARD	16	-	1	1	2	6	-	-	-	-	10	62.5
10 July	NEP(east)	50	-	11	3	3	1	1	2	-	-	21	42.0
11 July	TZR	50	1	2	16	2	2	1	3	1	-	28	56.0
18 July	REEF	43	-	-	1	2	20	-	-	-	-	23	53.5
Total		334	31	31	46	31	69	7	7	1	3	226	67.7

1/ NEP(east)=east side of Northeast Point; NEP(west)=west side of Northeast Point; ZAP=Zapadni; TZR=Tolstoi-Zapadni Reef; REEF=Reef; L-K=Lukanin-Kitovi; POL=Polovina; ZAP(SG)=Zapadni, St. George Island; NOR=North; ZAP PT=Zapadni Point; ARD=Ardiguen. Zapadni Point and Ardiguen are inaccessible areas where seals are not driven and killed.

2/ Does not include one seal tagged on REEF on 24 June and recovered in 1968 (date unknown) on Southeastern Rookery, Medny Island, U.S.S.R.

were recaptured and killed within 2 weeks of tagging, 68 percent were taken by the end of the killing season in 1968.

Telemetry

Radio transmitters were placed on young male fur seals on St. George Island in 1967 and on St. Paul Island in 1968. Five seals were radio-tagged each year, and each was also double-tagged on his front flipper with cattle-ear tags so that he could be identified if the transmitter was lost.

In 1967, the transmitters were dipped in Tygon[3] epoxy, wrapped in Scotch electricians tape, and placed around the neck of the seals. The radios tended to short out and not function because these materials were not waterproof, and antennas were broken, presumably by seals accidentally falling against rocks. The longest period of transmission in 1967 was 3 days from a seal that moved from the hauling ground on East Rookery to that on North Rookery on St. George Island.

A nylon harness used in 1968 stayed on well and did not seem to impede the movements of the seals. Though the transmitters were potted in dental acrylic and silastic rubber, many of them leaked. The longest transmission was 9 days, from a seal that was tagged and stayed on Reef hauling ground, St. Paul Island, until accidentally taken in the kill on the 9th day. This seal was driven to the killing field twice but always returned to the area where it was tagged. Other recoveries were: (1) A seal that was harnessed but not radio-tagged on Reef hauling ground on 1 July and recovered there on 2 August; (2) a seal that was tagged on Northeast Point hauling ground on 6 July and recaptured on Ardiguen Rookery on 11 July; and (3) a seal, with a harness and identification tags, that was driven to the killing field from North hauling ground, St. George Island, on 26 July, and then released. The tag numbers of the latter were not recorded, but the seal had been harnessed and tagged on Tolstoi hauling ground, St. Paul Island, on either 8 or 13 July.

ADULT MALE SEALS ON THE HAULING GROUNDS

Adult males found on the Pribilof Islands during the breeding season can be classified as territorial or nonterritorial. The former establish and defend territories, whereas the latter, though similar in body size and other characteristics, roam freely and are usually on hauling grounds.

In 1965, 250 territorial males from rookeries were killed for a study of adult males (Johnson, 1968). This study was continued in 1967 when 100 nonterritorial males were killed on the hauling grounds. Table 39 summarizes the ages of the seals.

The study of 100 nonterritorial males killed in 1967 lends support to a traditional belief that adult males on hauling grounds are too young to compete for or maintain control of a territory. According to the age composition of these animals, most of the large males on

[3] Trade names referred to in this publication do not imply endorsement of commercial products.

Table 39.--Age composition of four groups of adult male seals from hauling grounds, St. Paul Island, 1967

Group	Age										
	7	8	9	10	11	12	13	14	15	17	18
	Number										
1	-	5	8	7	1	1	1	1	-	-	1
2	1	5	7	6	2	2	-	1	1	-	-
3	2	5	7	3	-	1	3	1	1	1	1
4	-	6	12	3	1	-	1	1	-	-	1
Total	3	21	34	19	4	4	5	4	2	1	3

hauling grounds are younger than territorial males on the rookeries. For example, nearly all of the latter studied in 1965 were 10 years old or older, but 58 percent of the 100 males taken from hauling grounds were younger than 10 years. Of the nonterritorial males, 42 were older than 9 years, but no evidence was found of an accumulation of senile males on the hauling grounds. About half of the nonterritorial males on hauling grounds are too young to compete successfully for territories, and half are old enough but are unsuccessful for unknown reasons.

Table 40 gives body length and weight, and weight of paired, preserved testes for nonterritorial males killed in 1967. Because of the small sample sizes, we cannot draw reliable conclusions from comparisons of these characteristics by age, but for all ages combined, the mean weight of paired testes from territorial males is greater than that of paired testes from nonterritorial males (table 41). In addition, the mean weight of testes of territorial males collected in 1965 from 8 to 23 June was about 13 g. heavier than that of testes collected from 5 to 15 July. The body weights of territorial and nonterritorial males cannot be compared because territorial males killed 5-15 July 1965 were not weighed. Body length, however, can be compared because length would probably change little within a season. Sample sizes are small, but for each age the mean body length of nonterritorial males was less than that for territorial males. The comparisons are valid only if we can assume that there are no differences between years.

Table 40.--Mean length and weight of body and mean weight of testes[1/] of 100 adult male seals from hauling grounds, by age, St. Paul Island, 1967

Age	Seals	Mean body length	Mean body weight	Mean weight of paired testes
Years	Number	Cm.	Kg.	G.
7	3	180.3	154.8	106.8
8	21	184.7	155.6	104.5
9	34	189.1	169.0	123.9
10	19	188.9	169.8	120.4
11	4	185.0	159.7	121.1
12	4	198.4	172.6	116.6
13	5	185.3	147.9	115.2
14	4	192.9	163.1	103.7
15	2	192.5	178.2	95.4
17	1	195.0	168.7	108.3
18	3	195.0	172.0	118.8
All ages	100	188.4	164.8	116.1

1/ Preserved in formalin.

Table 41.--Measurements of territorial[1] and nonterritorial[2] male seals of selected ages,[3] St. Paul Island

[Numbers of seals in parentheses]

Age	Territorial males				Nonterritorial males		
	18-23 June 1965			5-15 July 1965[4]	5-8 July 1967		
	Mean body length	Mean body weight	Mean weight paired testes	Mean weight paired testes	Mean body length	Mean body weight	Mean weight paired testes
Years	Cm.	Kg.	G.	G.	Cm.	Kg.	G.
9	197.9 (8)	195.4 (9)	113.8 (9)	133.3 (15)	189.1 (34)	169.0 (34)	123.9 (33)
10	198.5 (24)	189.8 (28)	108.8 (28)	125.9 (36)	188.9 (19)	169.8 (19)	120.4 (19)
11	193.7 (12)	191.1 (19)	114.3 (19)	121.3 (39)	185.0 (4)	159.7 (4)	121.1 (4)
12	199.5 (8)	194.9 (8)	107.6 (8)	122.1 (11)	198.4 (4)	172.6 (4)	116.6 (4)
13	199.3 (15)	193.0 (16)	116.1 (17)	126.3 (17)	185.3 (5)	147.9 (5)	115.2 (5)

1/ Killed in 1965.
2/ Killed in 1967.
3/ Seals in ages 9 to 13 were selected because most measurements were made for these animals.
4/ Seals were neither measured nor weighed in July 1965.

SUMMARY

Field investigations on the Pribilof Islands in 1968 were conducted for continuing studies of the fur seal population and the level at which it will produce a maximum sustained yield.

A kill of 44,292 males in ages 2 to 6 included 35,292 from St. Paul Island and 9,000 from St. George Island. Ages were not determined for 1,333 young males.

A kill of 13,297 females in ages 2 to 24 included 10,544 from St. Paul Island and 2,753 from St. George Island. Ages were not determined for 38 females.

The number of dead pups counted was 26,563 on St. Paul Island and 4,875 on St. George Island.

Causes of death among 379 pups that died on three study areas by 15 August were malnutrition (48 percent), hookworm disease (17 percent), trauma (6 percent), microbial infections (5 percent), perinatal complex (5 percent), miscellaneous (2 percent), and unknown (3 percent). Fourteen percent of the pups were unsuitable for examination.

The number of dead males counted was 587 from 1965 to 1968 on St. Paul Island and 114 from 1966 to 1968 on St. George Island. Dead females counted from 1966 to 1968 were 490 on St. Paul Island and 106 on St. George Island.

An estimated 7,924 harem and 4,383 idle males were on the Pribilof Islands in 1968.

Pregnancy rates of females age 8 and older taken from hauling grounds were 42 percent for 1,058 killed in 1968 and 42 percent for 198 taken in 1958. Pregnancy rates of females taken from rookeries were 99 percent for 84 killed in 1956 and 100 percent for 221 taken in 1957.

Average weights of 9.6 kg. for males and 8.3 kg. for females on St. Paul Island were within 0.1 kg. of the average weights of pups weighed there from 1957 to 1968. Untagged males on

Robben Island were significantly heavier than untagged males on St. Paul Island, and tagged pups on both islands weighed less than untagged pups.

Single U-series tags were attached to the right front flippers and the tip of the same flipper was removed as a checkmark on 9,200 pups regardless of sex on St. Paul Island and on 2,475 on St. George Island.

A total of 714 males were double-tagged as yearlings on St. Paul Island with 1U-series tags.

A total of 1,495 males known or believed to be 2 years old were double-tagged on St. Paul Island with 2U-series tags.

Seals marked on St. Paul and St. George Islands in previous years and recovered there in 1968 included 3,907 that had been single-tagged or marked as pups and 1,197 that had been double-tagged at age 1 or older. Thirty-nine seals tagged as pups by Soviet biologists were killed on the Pribilof Islands in 1968.

Most tag loss apparently occurs soon after tagging, and the probability of loss becomes less thereafter.

The recovery rate for tags applied to pups in September has been significantly higher than that for tags applied to pups in August.

Marked pups apparently have a higher survival rate than tagged and checkmarked pups; the rate of recovery for males given a mark in 1965 and recovered at age 3 in 1968 was 1.17 times that of animals given a tag and a checkmark.

According to recoveries of marked seals, the total number of pups born on the Pribilof Islands has decreased each year from 643,000 in 1960 to 397,000 in 1965. The latter estimate is similar to one of 350,000 obtained for the 1965 year class from shearing and sampling.

Estimates of the number of yearling males from all recoveries of marked seals for several year classes are 82,000 (1961), 79,000 (1962), 115,000 (1964), and 80,000 (1965).

Recoveries of marked seals yielded estimates of 25,000 3-year-old males from the 1963 year class and 70,000 2-year-old males from the 1964 year class still living after the kill in 1966.

The predicted kill of males on the Pribilof Islands in 1968 included 4,500 of ages 2 and 5, 28,000 of age 3, and 17,000 of age 4. Actual kills were 4,054 of ages 2 and 5, 23,149 of age 3, and 16,959 of age 4.

A forecast of the kill on the Pribilof Islands in 1969 includes 4,200 of ages 2 and 5, 29,500 of age 3, and 22,900 of age 4.

Young males (ages 2-5) tagged and recovered on St. Paul Island in 1968 provided information on the movements of these animals. Seals tagged in June were recovered at a greater rate than were seals tagged in July, and the rate for seals tagged on hauling grounds inaccessible to the kill was low compared to the rate for seals tagged on accessible hauling grounds.

Radio transmitters were attached to five seals on St. George Island in 1967 and to five on St. Paul Island in 1968. The longest transmission was 9 days.

More than half of 100 adult males from hauling grounds were age 9 or less. Most adult males on rookeries are age 10 or older.

ACKNOWLEDGMENTS

The research in 1968 was completed with the cooperation of C. Howard Baltzo, Program Director; Bertel W. Johnson, Management Staff Officer; Richard A. Hajny, Wildlife Management Biologist; Harold Thayer, Program Construction Supervisor; Victor Misiken, Village Foreman; Alex Melovidov, Sealer Foreman; Lee Paola, Superintendent, Oregon-Alaska Marine Products; and Tikhon Stepetin, President, St. Paul Island Community Council.

Kazumoto Yoshida from the Japanese Fishery Agency observed fur seal research on the Pribilof Islands from 3 to 25 July.

GLOSSARY

The following terms used in fur seal research and management on the Pribilof Islands have special meanings or are not readily found in standard dictionaries.

Checkmark A notch, slit, hole, or other mark made on a seal flipper when a tag is applied, to ensure later recognition of an animal that has lost its tag. See mark and lost tag.

Drive The act of surrounding and moving groups of seals on land from one location to another.

Escapement Seals that were not killed because they were too old, too large, or were not available.

Female kill That part of the annual harvest devoted principally to the kill of female seals, usually in August. See male kill.

Hauling ground An area, usually near a rookery, on which nonbreeding seals congregate. See rookery.

Haul out The act of seals moving from the sea to a rookery or hauling ground on shore.

Known-age Refers to a seal whose age is known because the animal bears an inscribed tag or has a certain combination of tag-scar and checkmark.

Lost-tag Refers to a seal known to have been tagged as a pup because it bears a checkmark.

Lost-tag-to-tag ratio The number of seals that have lost tags as compared with the number retaining tags.

Male kill That part of the annual harvest devoted principally to the kill of male seals, usually in late June, in July, and in early August. See female kill.

Male seals, adult Class 1 Shoreline -- Full-grown males about age 10 and older without females but apparently with established territories at the high-tide mark.

Class 2 Territorial without females -- Full-grown males about age 10 and older without females but with established territories on the rookery.

Class 3 Territorial with females -- Full-grown males about age 10 and older with females and established territories on the rookery.

Class 4 Back fringe -- Full-grown and partly grown males about age 7 and older without females and territories that are along the inland fringe of the rookery.

Class 5 Hauling ground -- Full-grown and partly grown males about age 7 and older without females that are on traditional hauling grounds.

Mane Long, silver-colored guard hairs on the shoulders and on back of the neck--a secondary sex characteristic of males. The mane appears on some males at age 5, on most at age 6, and on all at age 7.

Mark Examples of marks are a tag, the tip of a digit from a hind flipper removed, a V-notch cut into the leading edge of a front flipper near the tip, or the tip of a front flipper sliced off. When applied to seals in conjunction with tags, marks made by removing part of a flipper are considered checkmarks. See checkmark and lost-tag.

Marked-to-unmarked ratio The number of marked seals compared with the number of unmarked seals.

Pregnancy rate Percentage of females that were carrying or had borne pups in the year of examination.

Rookery An area on which breeding seals congregate.

Round The sequence in which hauling grounds on St. Paul Island are visited to harvest seals. When used, a circuit or round of the hauling grounds is completed in 5 days and the procedure is repeated throughout the kill of males. The mean round of the kill is calculated by multiplying the round number by the number killed in that round and dividing the cumulative product by the cumulative kill.

Roundup The act of surrounding and collecting seals to be driven for harvesting, tagging, or other purposes.

Tagged Refers to a seal with an inscribed metal tag or tags attached to one or more of its flippers.

Tag recoveries Includes seals that were given tags or other marks, and seals identified from checkmarks as having lost their tags. See checkmark, mark, lost tag, and tagged.

Part II. PELAGIC FUR SEAL INVESTIGATIONS, 1968

The objectives of pelagic research in 1968 were: (1) to collect information on the distribution of fur seals in winter, including the arrival time of the year classes, and their feeding habits off Washington; and (2) to resurvey migration, distribution, and feeding habits of fur seals in waters of western Alaska with special emphasis on collecting young females for studies of reproductive condition in late spring and summer.

RESEARCH IN 1968

We carried out our investigations off Washington from 27 November to 21 December 1967 and from 2 January to 26 February 1968. Investigations were conducted in Alaska waters from 18 May to 25 August. The M/V Tonquin[4] was chartered for the cruise (No. 29) off Washington and the M/V New St. Joseph[5] for the cruise (No. 30) in Alaska waters. Table C-1 shows participants and their itineraries. Kazumoto Yoshida from the Japanese Fishery Agency observed pelagic sealing methods aboard the M/V New St. Joseph from 10 June to 2 July 1968.

Equipment and methods used to collect and examine seals are described in previous reports (Fiscus, Baines, and Wilke, 1964; Fiscus and Kajimura, 1967).

Sonar (Western Marine Electronics [Wesmar] Horizontal-scan sonar model SS200) was installed in the Tonquin so that the equipment could be evaluated for use in locating and tracking fur seals. Factory representatives calibrated and demonstrated use of their sonar during the cruise. We concluded, however, that sonar is currently of no advantage in pelagic fur seal research. Seals encountered during tests of the equipment behaved normally; they were usually lying on the surface when sighted, and dived and changed course rapidly when approached and disturbed. We found it extremely difficult to find a seal on the surface by sonar because we could not separate surface and wave returns from seals on the sonar screen. Air bubbles in the vessel's wake were detected and shown on the screen. They formed an effective barrier to sonar through which a seal could escape undetected. Seals below the surface were apparently detected just after they dived, but most disappeared rapidly from the screen when followed. The sonar operator could then only scan in the direction the seal appeared to be traveling, a futile effort in each instance.

DISTRIBUTION OFF WASHINGTON

Seals were present off Washington in late November and in early December. Their numbers increased along the Continental Shelf in the second and third week of December. In January and February seals were abundant along the Continental Shelf from Grays Harbor to the Columbia River and present in lesser numbers from Grays Harbor northward along the shelf to Cape Flattery. Figures 10 to 13 and tables C-2 to C-5 show the distribution of seals.

DISTRIBUTION IN ALASKA WATERS

Figures 14 to 18 and tables C-6 to C-11 show the distribution of seals in areas we surveyed from the New St. Joseph. A concentration of seals (105 sighted) was found on 21 May in the eastern Gulf of Alaska.

We cruised the western Gulf of Alaska and waters off Kodiak Island the last of May but failed to locate any concentrations of seals where they were in previous years. Only 21 animals were sighted on 1-2 June west from Kodiak Island toward the Shumagin Islands. We saw seals south of the Shumagin Islands on 3-4 June. We found concentrations of seals on 17-18 and 27-28 June south and east of Akutan Pass while working south of the eastern Aleutian Islands 6-30 June.

The M/V Pribilof[6] carried U.S. observers from the Pribilof Islands to Medny Island, Commander Islands, and back between 26 June and 10 July 1968. One to three observers watched for seals during most daylight hours; the officers and crew of the Pribilof assisted. Figure 19 shows the daily run and seals sighted.

Seals were abundant on 6 July near Medny Island but most of the seals seen were sighted on 27 June and 9 July off the Continental Shelf 148 to 370 km. (80-200 miles) from the Pribilof Islands. Only three seals were seen north of the western Aleutian Islands.

We surveyed the Bering Sea and the Pacific Ocean near the eastern Aleutians in July. No concentrations of seals were located until 21 July, when 78 were sighted north of Akutan Island.

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[4] Registered length 29.4 m. (96.6 feet), 200 net tons, 350 horsepower, cruising speed 16.7 km. per hour (9 knots).

[5] Registered length 22.4 m. (73.6 feet), 53 net tons, 340 horsepower, cruising speed 18.5 km. per hour (10 knots).

[6] Bureau of Commercial Fisheries Pribilof Islands supply vessel; registered length 64 m. (210 feet), 1,200 gross tons, 14,000 horsepower, cruising speed 22.2 km. per hour (12 knots).

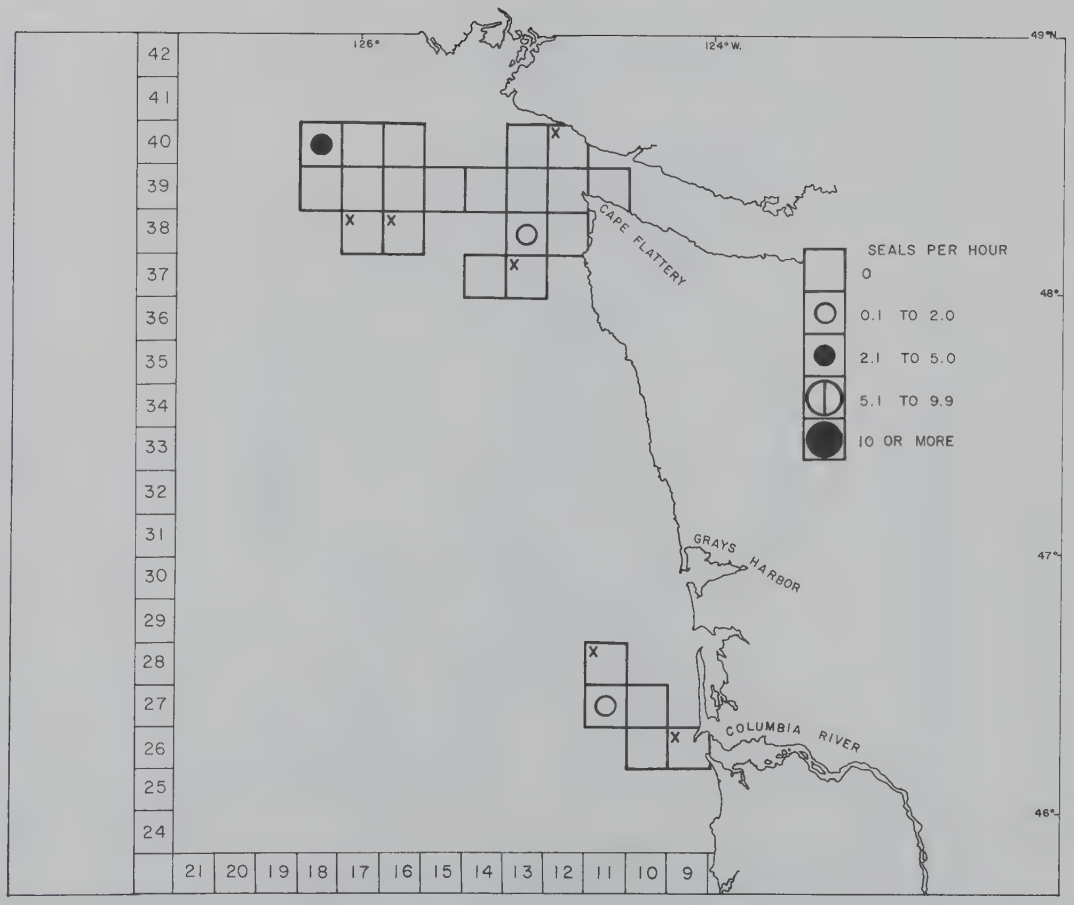

Figure 10.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in November 1967 off Washington. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X." See table C-2 for detailed data.

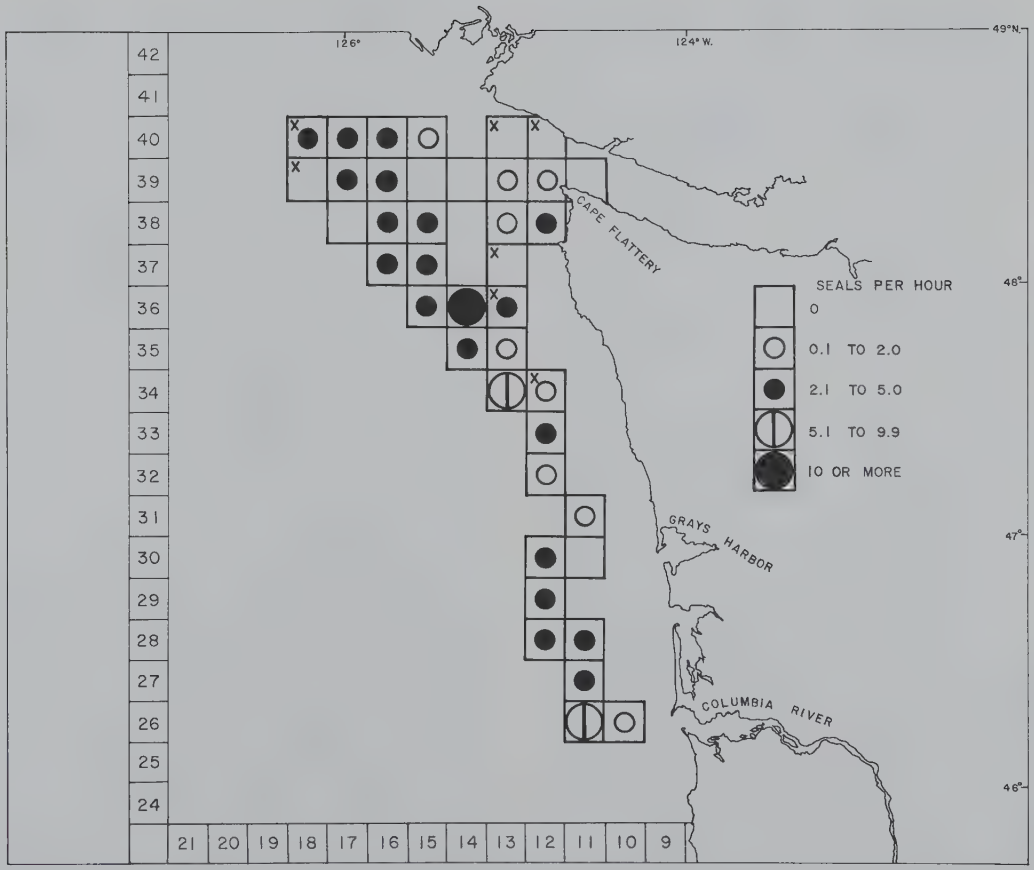

Figure 11.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in December 1967 off Washington. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X." See table C-3 for detailed data.

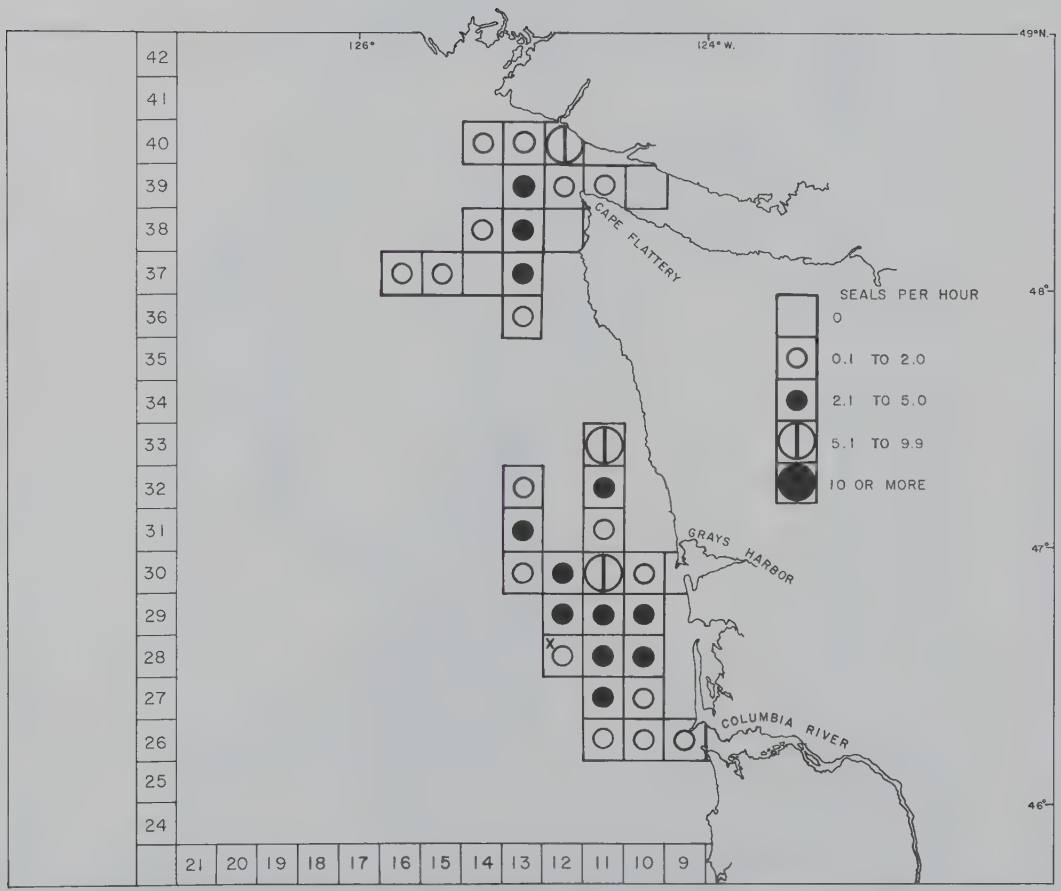

Figure 12.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in January 1968 off Washington. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X." See table C-4 for detailed data.

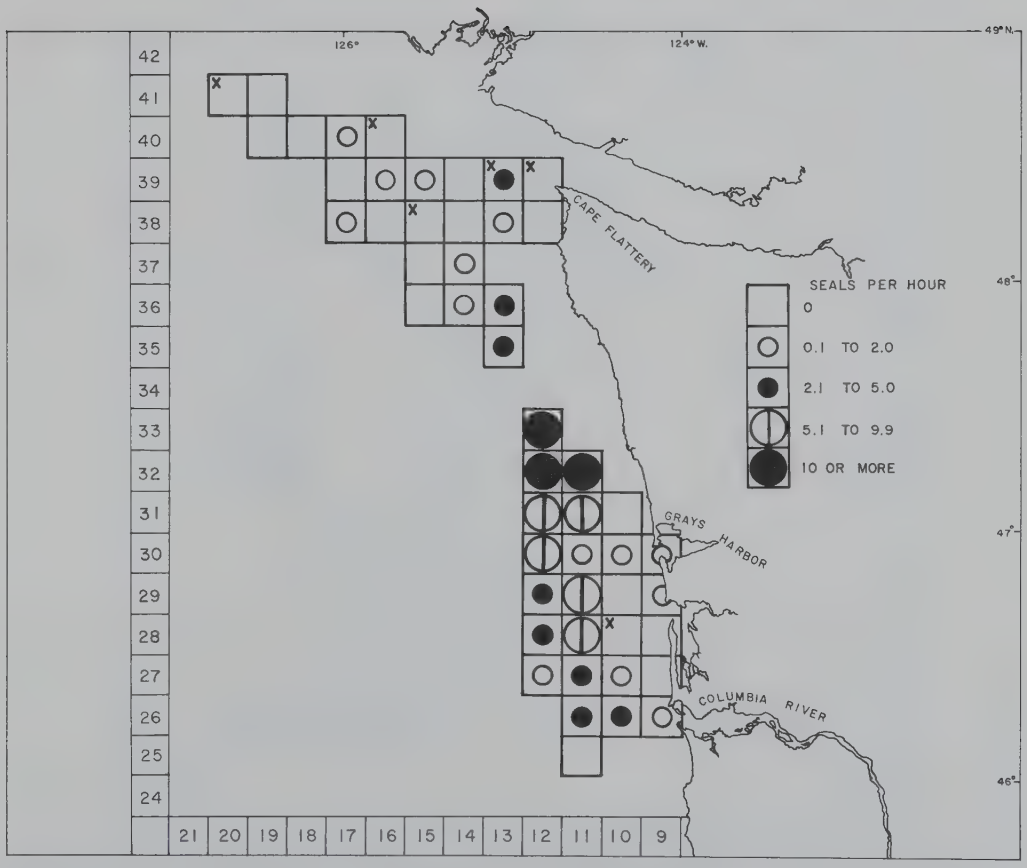

Figure 13.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in February 1968 off Washington. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X." See table C-5 for detailed data.

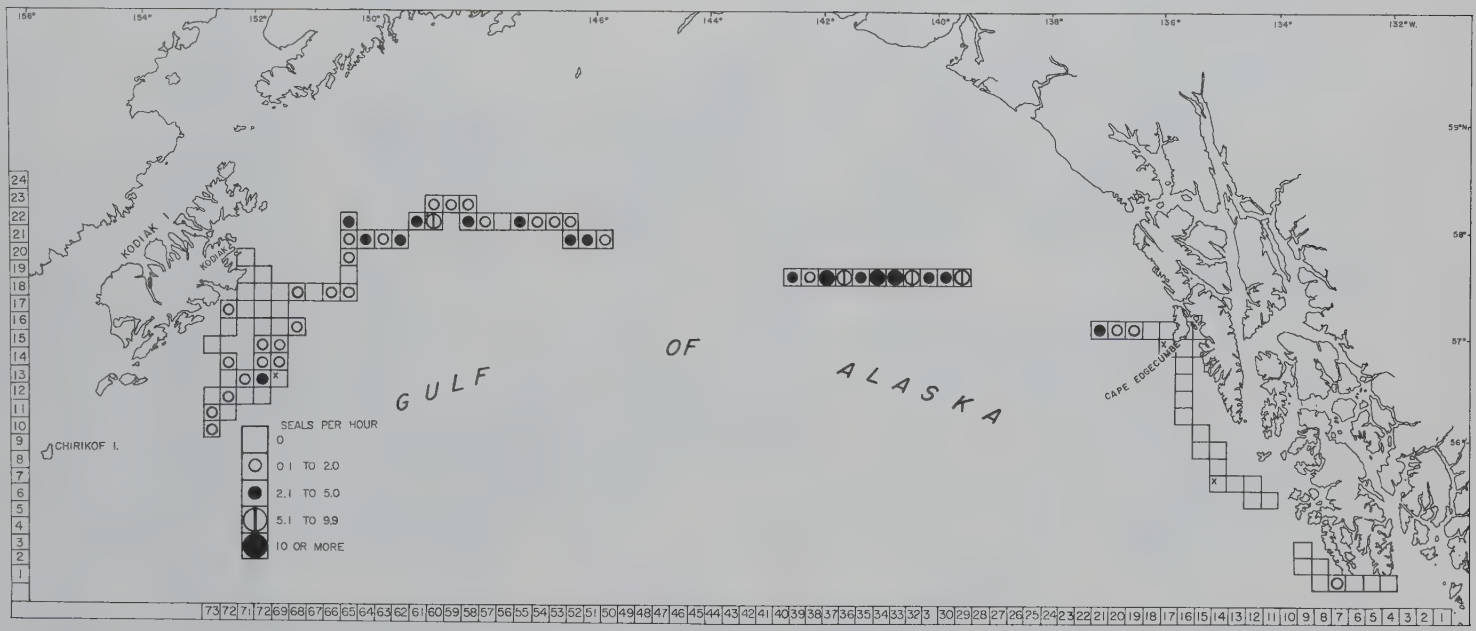

Figure 14.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in May 1968 in Alaska waters between Dixon Entrance and long. 156° W. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X."

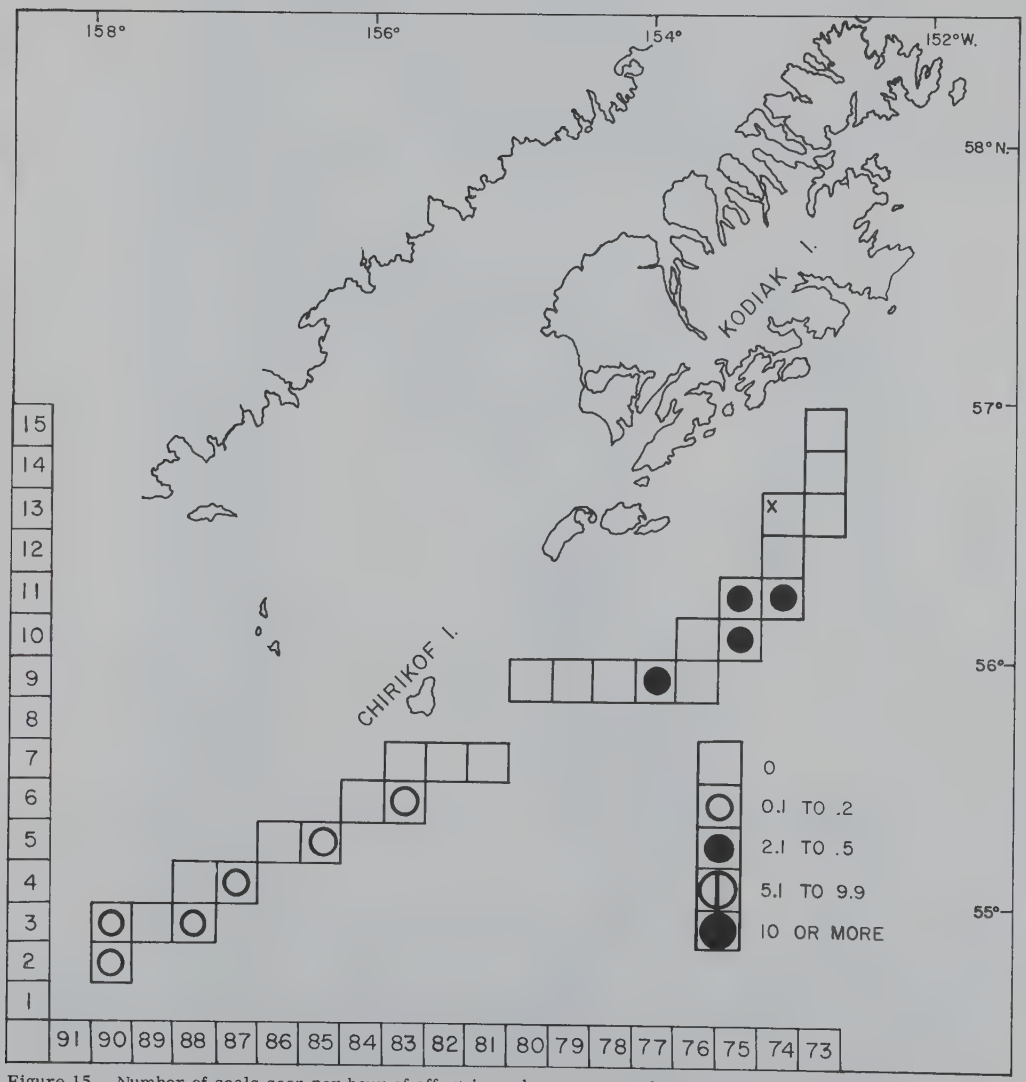

Figure 15.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in June 1968 in Alaska waters between Kodiak Island and long. 158° W. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X."

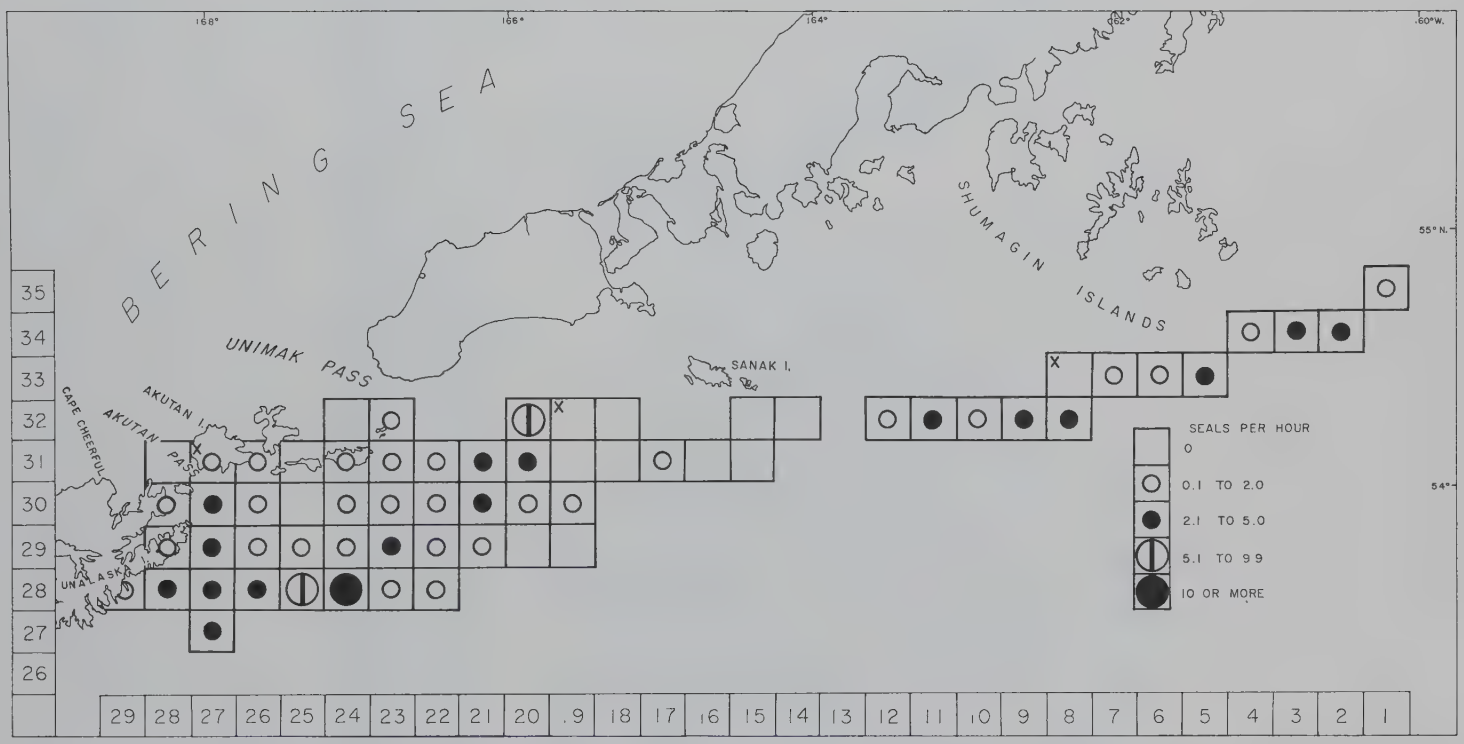

Figure 16.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in June 1968 in Alaska waters from long. 160° W. to Bering Sea. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X."

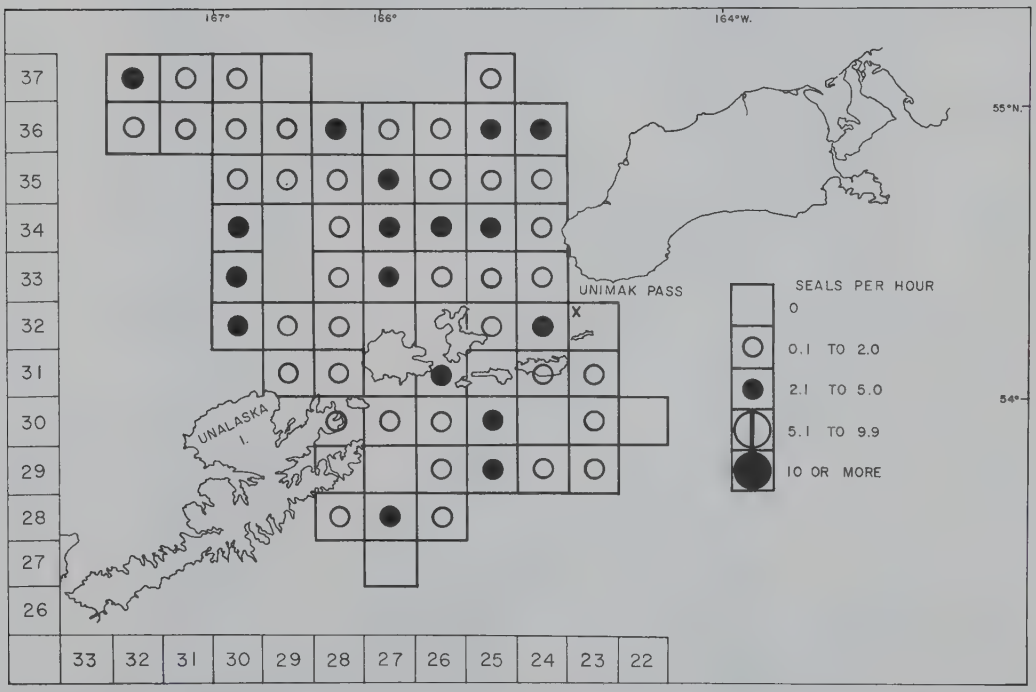

Figure 17.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in July 1968 in Alaska waters near the eastern Aleutian Islands. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X."

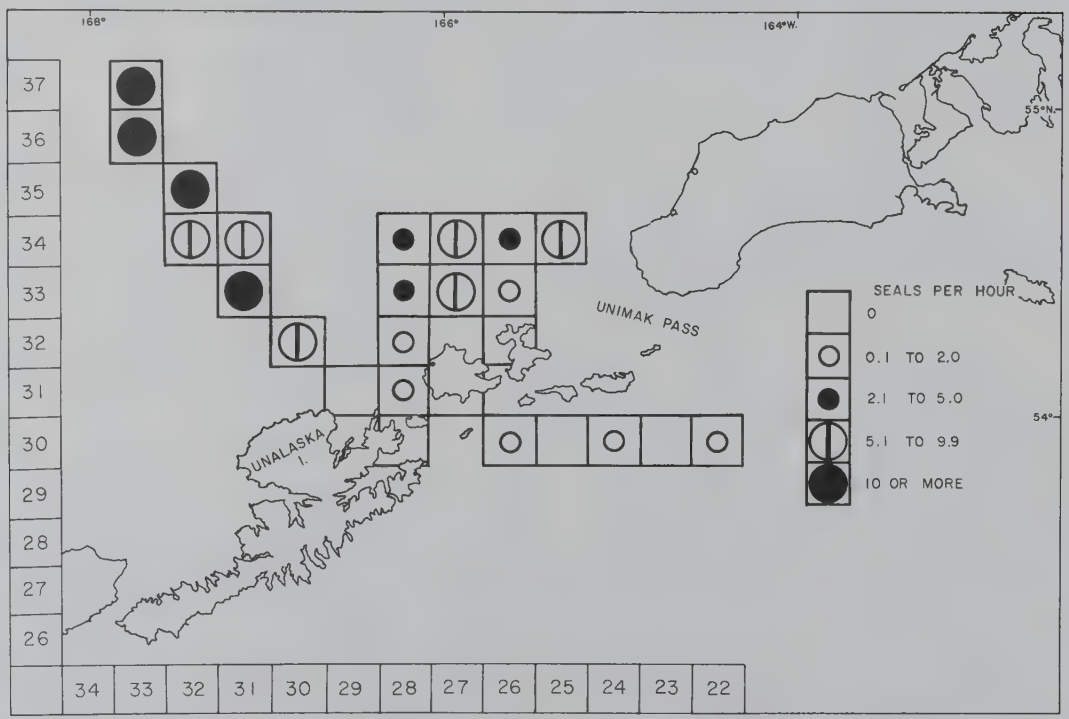

Figure 18.--Number of seals seen per hour of effort in each square (areal unit) occupied by a research vessel in August 1968 in Alaska waters near the eastern Aleutian Islands. The sides of each square measure 18.52 km. (10 nautical miles). Squares occupied for less than 0.5 hours are marked "X."

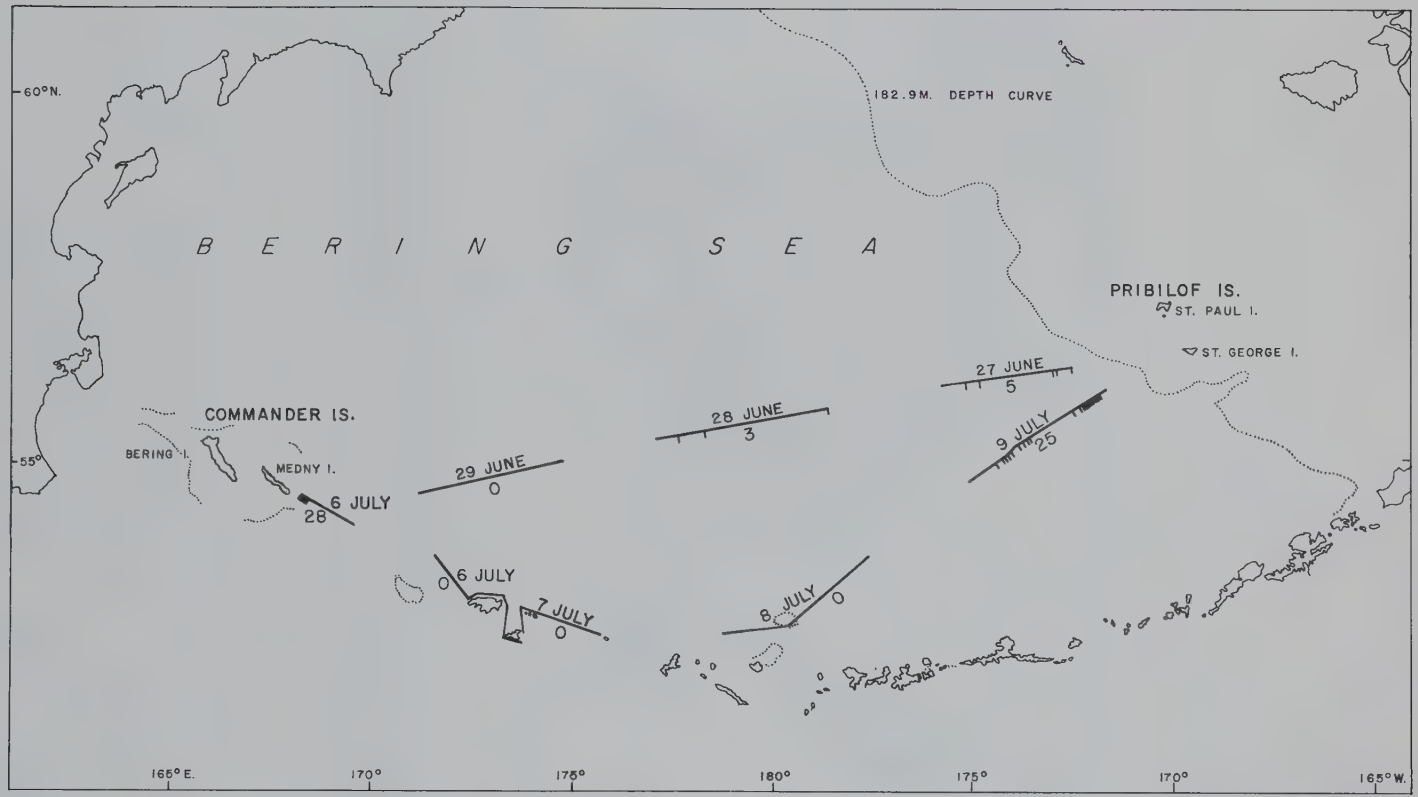

Figure 19.--Tracklines of the M/V Pribilof from 27 June to 9 July 1968. The position of each seal sighted is shown by a mark (') just below the trackline, together with the total number seen.

We saw considerable numbers of seals in the Bering Sea along and outside the Continental Shelf from Unalaska Island east to Unimak Pass from 1 to 15 August.

The following surveys are not shown on any of the figures:

Date	Distance		Direction and locality	Seals seen
	Km.	(Miles)		Number
Aug.				
12	64	(40)	St. Paul to St. George	20
15	55	(30)	56 km. (30 miles) south of St. George to 111 km. (60 miles) northwest of Cape Cheerful, Unalaska Island (Just off the Continental Shelf between Pribilof Islands and feeding grounds near eastern Aleutian Islands)	93
18	230	(124)	Along Continental Shelf between Sanak Island and Shumagin Islands	23
19	185	(100)	Past Chirikof Island	5
20	148	(80)	Toward town of Kodiak	8
22	185	(100)	Eastward from Kodiak	0
23	222	(120)	Southeastward in Gulf of Alaska	0
24	185	(100)	137 km. (74 miles) west of Cape Edgecumbe	1

ABUNDANCE

The numbers of seals sighted, collected, wounded and lost, and killed and lost were 1,078, 374, 39, and 26 off Washington and 1,509, 456, 27, and 78 in Alaska waters. Tables C-12 and C-13 give numbers and percentages of seals in these categories for 1958-68.

Tables C-14 to C-17 show the number of seals seen and collected off Washington and in Alaska waters in relation to effort by 10-day periods.

Seals were seen in groups of one to nine animals off Washington (table C-18) and in groups of one to five in Alaska waters (table C-19). Seals travel alone more frequently in the spring and summer in Alaska waters than in winter off Washington.

Incomplete data on six seals taken in Alaska waters are not included in any of the following tables.

AGE AND SEX

Seals collected at sea are considered to have passed into the next higher age group on 1 January (Standing Scientific Committee of the North Pacific Fur Seal Commission, 1963). The ages of seals collected in November and December 1967, however, were increased 1 year to permit comparisons with seals taken after 1 January 1968. Thus, seals of the same year class were given the same age in all tables in this report.

Table 42 gives the age and sex of seals collected off Washington and Alaska in 1967-68. About 50 percent of the females killed were from 1 to 7 years old.

Seventy-four yearling seals (1967 year class) were collected January-February 1968 for continuing studies of these animals during their first year of life, a period when fur seals suffer the greatest mortality. For example, general body condition was appraised by measuring the subcutaneous layers of fat at their thickest points over the sternum and ventral to the pelvic region (table C-20). Additional information on these yearlings is given elsewhere in this report.

TAG RECOVERIES

In 1968, we took 7 males in ages 2 to 16 years and 31 females between the ages of 1 and 16 years that had tags or other marks (table 43). No Soviet tags were found attached to seals collected in 1968.

LENGTHS AND WEIGHTS

Mean lengths and weights are given for pregnant, post partum, and nonpregnant females collected in 1967-68 in tables C-21 to C-26, and for males in tables C-27 and C-28.

Sex, length, and weight were not determined for two very small embryos, and the data have not yet been obtained for 17 fetuses on loan. Crown rump rather than total length measurments were taken from 24 male and 33 female fetuses because of their small size, and these fetuses were weighed in the laboratory rather than at sea because accurate weights could not be obtained on a rolling and pitching vessel. Table C-29 gives crown-rump length and weight after preservation in formalin.

Table C-30 shows measurements of total length and of the weight of unpreserved fetuses.

REPRODUCTION

Table C-31 shows the reproductive condition of female seals collected by month in 1967-68. Five primiparous 4-year-olds were the youngest and one multiparous 21-year-old was the oldest among pregnant seals collected in 1967-68.

The pregnancy rates of fur seals collected in the eastern Pacific Ocean from 1958 to 1966 were tested to see if they differed by area and year of collection. The largest numbers of seals were collected off California (36.5 percent) and in the Bering Sea (28.4 percent).

Table 42.--Age and sex, by month, of fur seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	November 1967				December 1967				January 1968				February 1968				May 1968				June 1968				July 1968				August 1968				Total			
	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female	
Years	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	-	-	-	-	-	-	-	-	11	78.6	15	14.8	16	84.2	32	20.6	2	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	23.0	47	6.8
2	-	-	1	33.3	-	-	3	3.7	-	-	1	1.0	1	5.3	2	1.3	8	27.6	1	1.4	1	4.3	-	-	6	23.2	1	1.0	5	35.8	-	-	21	16.7	9	1.3
3	-	-	-	-	-	-	7	8.6	2	14.3	2	2.0	2	10.5	4	2.6	9	31.1	3	4.3	12	52.3	-	-	13	50.0	9	8.8	3	21.5	10	12.6	41	32.5	35	5.0
4	-	-	-	-	1	100.0	11	13.6	1	7.1	16	15.8	-	-	18	11.6	6	20.7	5	7.1	2	8.7	8	7.5	3	11.6	18	17.6	1	7.1	19	24.0	14	11.1	95	13.7
5	-	-	-	-	-	-	4	4.9	-	-	6	5.9	-	-	7	4.5	2	6.9	4	5.7	3	13.1	4	3.7	1	3.8	9	8.8	-	-	3	3.8	6	4.7	37	5.3
6	-	-	1	33.3	-	-	4	4.9	-	-	6	5.9	-	-	12	7.7	1	3.4	2	2.9	-	-	10	9.3	-	-	8	7.8	-	-	4	5.1	1	0.8	47	6.8
7	-	-	-	-	-	-	10	12.4	-	-	9	8.9	-	-	16	10.3	-	-	6	8.6	2	8.7	11	10.3	1	3.8	10	9.8	-	-	7	8.8	3	2.4	69	10.0
8	-	-	-	-	-	-	8	9.9	-	-	4	4.0	-	-	2	1.3	-	-	3	4.3	-	-	13	12.2	-	-	5	4.9	-	-	3	3.8	-	-	38	5.4
9	-	-	1	33.4	-	-	8	9.9	-	-	7	6.9	-	-	9	5.8	-	-	4	5.7	-	-	5	4.7	1	3.8	4	3.9	2	14.3	2	2.5	3	2.4	40	5.7
10	-	-	-	-	-	-	3	3.7	-	-	9	8.9	-	-	11	7.1	-	-	3	4.3	1	4.3	7	6.5	1	3.8	6	5.9	-	-	1	1.3	2	1.6	40	5.7
11	-	-	-	-	-	-	5	6.2	-	-	4	4.0	-	-	12	7.7	1	3.4	5	7.1	1	4.3	9	8.4	-	-	2	2.0	-	-	2	2.5	2	1.6	39	5.6
12	-	-	-	-	-	-	5	6.2	-	-	8	7.9	-	-	9	5.8	-	-	6	8.6	-	-	8	7.5	-	-	1	1.0	-	-	3	3.8	-	-	40	5.7
13	-	-	-	-	-	-	1	1.2	-	-	2	2.0	-	-	2	1.3	-	-	7	10.0	1	4.3	4	3.7	-	-	5	4.9	-	-	3	3.8	1	0.8	24	3.4
14	-	-	-	-	-	-	1	1.2	-	-	1	1.0	-	-	4	2.6	-	-	5	7.1	-	-	5	4.7	-	-	6	5.9	-	-	4	5.1	-	-	26	3.7
15	-	-	-	-	-	-	2	2.5	-	-	3	3.0	-	-	8	5.2	-	-	1	1.4	-	-	7	6.5	-	-	5	4.9	1	7.1	4	5.1	1	0.8	30	4.3
16	-	-	-	-	-	-	2	2.5	-	-	4	4.0	-	-	4	2.6	-	-	5	7.1	-	-	5	4.7	-	-	1	1.0	1	7.1	5	6.3	1	0.8	26	3.7
17	-	-	-	-	-	-	-	-	-	-	4	4.0	-	-	2	1.3	-	-	2	2.9	-	-	5	4.7	-	-	4	3.9	1	7.1	4	5.1	1	0.8	21	3.0
18	-	-	-	-	-	-	2	2.5	-	-	-	-	-	-	1	0.7	-	-	2	2.9	-	-	3	2.8	-	-	2	2.0	-	-	1	1.3	-	-	11	1.6
19	-	-	-	-	-	-	2	2.5	-	-	-	-	-	-	-	-	-	-	2	2.9	-	-	2	1.9	-	-	3	2.9	-	-	1	1.3	-	-	10	1.4
20	-	-	-	-	-	-	1	1.2	-	-	-	-	-	-	-	-	-	-	2	2.9	-	-	1	0.9	-	-	-	-	-	-	3	3.8	-	-	7	1.0
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.4	-	-	-	-	-	-	2	2.0	-	-	-	-	-	-	3	0.4
22	-	-	-	-	-	-	1	1.2	-	-	-	-	-	-	-	-	-	-	1	1.4	-	-	-	-	-	-	1	1.0	-	-	-	-	-	-	3	0.4
23	-	-	-	-	-	-	1	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
Total	-		3		1		81		14		101		19		155		29		70		23		107		26		102		14		79		126		698	

Table 43.--Tag recoveries from fur seals collected pelagically in the eastern North Pacific by the United States in November and December 1967, and January, February, May, June, July, and August 1968.

[Figures in parentheses indicate number of animals that had lost tags; these are included in the totals. Seals that were marked only are included in tagged seal totals.]

Age	Year of tagging	Tag series	Seals tagged or marked	Tag recovery		Seals collected in each age group[1]	
				♂	♀	♂	♀
Years			Number	--Number--		--Number--	
			1967				
3	1965	R	30,087	--	1	--	7
6	1962	O	49,908	--	1(1)	--	4
7	1961	N	49,921	--	1	--	10
16	1952	E	19,979	--	1	--	2
			1968				
1	1967	T	12,472	--	1	29	47
2	1966	S	24,577	1	--	21	5
3	1965	R	30,087	2	1(1)	41	28
	1967	[2] 2T		1			
4	1964	Q	24,991	--	5(1)	13	84
	1966	[2] 2S		1			
5	1963	P	24,971	1	1(1)	6	33
6	1962	O	49,908	--	3(2)	1	42
7	1961	N	49,921	--	4(1)	3	59
8	1960	M	59,981	--	4(2)	--	30
9	1959	L	49,881	--	1(1)	3	31
10	1958	K	49,917	--	4(1)	2	37
11	1957	J	49,842	--	2(1)	2	34
13	1955	H	49,870	--	1(1)	1	23
16	1952	E	19,979	1	--	1	24

[1] Table does not include seals born in years when seals were not tagged, nor year classes from which no tagged seals were taken.

[2] Animals tagged as 2-year-olds, based on body length.

Samples were collected from January to April from California to Southeast Alaska, from April to June in Yakutat and the Gulf of Alaska, and from May to October in western Alaska, Unimak Pass, and the Bering Sea (table 44). The tests were restricted to seals 5 years old and older, because younger seals have very low pregnancy rates and thus are not important to the breeding population. Ages 5, 6, and 7 were tested separately, because the percentage of females pregnant differ for those ages (38, 73, and 81 percent, respectively). The pregnancy rates for females 8 to 13 years old are similar (fig. 20). An analysis of variance test of the pregnancy rates (transformed by arcsin) by year, showed no significant differences between ages or years for females 8 to 13 years old ($P > 0.25$). According to a test for nonadditivity, the transformed data were additive ($P > 0.25$). Ages 8 to 13, therefore, were pooled (mean pregnancy rate of 89 percent). Females 14 years old and older were pooled to increase sample sizes and to minimize the effects of errors known to exist in assigning ages to older animals. Chi-square was used to test for significance between numbers of pregnant and nonpregnant seals ($P < 0.05$ indicates significant differences). Comparisons were limited to samples of 15 or more seals.

Five-year-old seals had significantly different pregnancy rates in the different areas in 3 to 4 years when areas within years were tested ($0.01 < P < 0.05$, table 45). The pregnancy rates for females in ages 6, 7, 8 to 13, and ≥ 14 were similar when areas within years were tested ($P > 0.05$). Why only age 5 seals differed is not known.

When different years within areas were tested by chi-square, the pregnancy rates of seals collected off California were significantly different for all age groups except age 7 (table 46). Pregnancy rates for age groups other than 7 were low in 1964 and 1965 and high in 1958 for samples collected off California. Samples from California were collected in April-May 1964 and 1965 as opposed to January-April in the other years. Age 5 seals were collected during similar months off California in 1958, 1959, 1961, and 1966, but the pregnancy rates were not as high in 1961 and 1966 as in 1958 and 1959 (24-27 percent in 1961 and 1966 as compared to 60 percent in 1958 and 1959). If pregnant seals had already left the area off California to migrate to the Pribilof Islands before samples were collected in 1964 and 1965, then we would expect lower pregnancy rates. Nonpregnant seals may migrate to the Pribilof Islands later in the year than pregnant seals, or in some years may not return at all.

Pregnancy rates for seals in ages 8 to 13 collected in western Alaska in 1958, 1960, and 1962 were significantly different ($P \doteq 0.01$); the pregnancy rate in 1960 (96.7) was higher than the rate in 1958 (87.8) and 1962 (83.9). Pregnancy rates between years for 5-, 6-, and 7-year old females were similar within each age group for samples collected in the Bering Sea; pregnancy rates for females 8 to 13 and ≥ 14 years old were significantly different ($P \doteq 0.04$ and $P \doteq 0.01$, respectively). The pregnancy rate was low in 1964 for seals 8 to 13 and ≥ 14 years old collected in the Bering Sea.

It is difficult to explain the cause of the difference between years when the months of collecting are the same. If the difference is not real, possible explanations are sampling errors, errors in assigning ages, and segregation by reproductive condition.

Pregnancy rates varied more than we expected between areas, years, and months of collection. Pregnancy rates differed more for samples collected in different years in a particular area than for those collected in the same year but in different areas. The differences in the pregnancy rates indicate at least partial segregation of females at sea, within age by reproductive condition, and by age and month. No evidence exists that there has been a

Table 44.--Months of collection and number of female seals age 5 and older collected by the United States in the eastern Pacific, 1958-66

Year	Collection data	Area										Total
		Calif.	Oreg.	Wash.	B. C.	S. E. Alaska	Yakutat	Gulf of Alaska	Western Alaska	Unimak Pass	Bering Sea	
1958	Months	Feb. - Apr.	Apr.	Apr.	-	Feb. - Apr.	Apr. - May	May-June	June	-	June	
	Number	423	39	49	-	192	21	390	89	-	2	1,205
1959	Months	Jan. - Apr.	Jan. - Apr.	Apr.	-	-	-	-	-	-	-	
	Number	1,103	31	164	-	-	-	-	-	-	-	1,298
1960	Months	-	--	-	-	Mar. - Apr.	Apr.	Apr. - May	June		June-Aug.	
	Number	-	--	-	-	131	3	638	129		1/ 331	1,232
1961	Months	Jan. - Apr.	Apr.	Apr.	Feb. - Mar.	-	-	-	-	-	-	
	Number	733	25	238	51	-	-	-	-	-	-	1,047
1962	Months	-	-	-	-	-	May	-	May-Sept.	June-Oct.	May-Oct.	
	Number	-	-	-	--	-	2	-	233	332	508	1,075
1963	Months	-	-	-	-	-	-	-	-	-	July-Sept.	
	Number	-	-	-	-	-	-	-	-	-	1,043	1,043
1964	Months	Apr. - May	Apr. - May	May	-	-	-	-	-	-	July-Sept.	
	Number	201	3	9	-	-	-	-	-	-	406	619
1965	Months	Apr. - June	-	Apr.	-	-	-	-	-	-	-	
	Number	172	-	73	-	-	-	-	-	-	-	245
1966	Months	Jan. - Mar.	-	-	-	-	-	-	-	-	-	
	Number	318	-	-	-	-	-	-	-	-	-	318
Total		2,950	98	533	51	323	26	1,028	451	332	2,290	2/ 8,082
Percent		36.5	1.2	6.6	0.6	4.0	0.3	12.7	5.6	4.1	28.4	100.0

1/ Bering Sea and Unimak Pass combined.

2/ 4 less than total in table 4, Fiscus and Kajimura (1966).

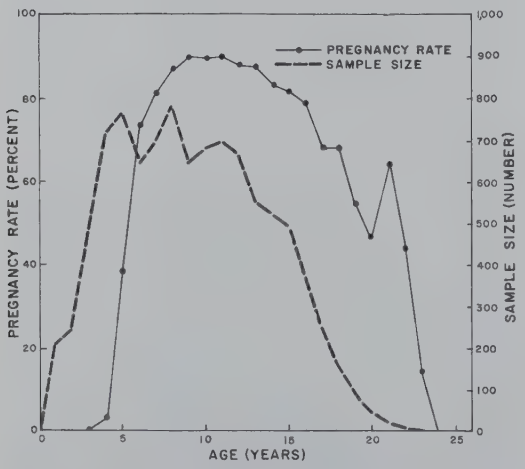

Figure 20.--Pregnancy rates and sample sizes, by age, of female seals collected in the eastern Pacific Ocean, 1958-66.

significant change in the pregnancy rate since 1958.

Table 47 shows the pregnancy rates of all female seals collected in the eastern Pacific Ocean by the United States each year since 1958; these seals are also listed in table C-32 by number and percentage pregnant for each area and month.

FEEDING HABITS

The stomachs of fur seals collected in the eastern and western Pacific Ocean and throughout the range of this animal consistently contained a variety of fishes and cephalopods. Fur seals feed principally between dusk and dawn.

Of 374 stomachs collected off Washington in November-December 1967 and January-February 1968, 251 (67 percent) contained food (table 48). Salmon, Oncorhynchus spp.; anchovy, Engraulis mordax; rockfish, Sebastodes spp.; eulachon, Thaleichthys pacificus; and

Table 45. --Pregnancy rates by year, area, and month of collection, and chi-square values for tests of pregnancy rates between areas in 1958, 1960-62, and 1964

[Sample sizes are shown in parentheses]

Age Years	Area							Chi-square	P
	Calif.	Wash.	S. E. Alaska	Gulf of Alaska	Western Alaska	Unimak Pass	Bering Sea		
					1958				
	Feb. - Apr.		Feb. - Apr.	May - June	June				
5	60.5 (38)	-	-	28.6 (21)	-	-	-	4.30	0.02
6	92.5 (40)	-	-	83.3 (36)	-	-	-	0.77	0.40
7	95.3 (43)	-	-	94.1 (34)	-	-	-	0.06	0.80
8-13	93.8 (226)	-	91.9 (74)	88.2 (228)	87.8 (49)	-	-	5.06	0.17
≥14	92.1 (76)	-	84.3 (115)	84.5 (71)	-	-	-	2.76	0.26
					1960				
			Feb. - Apr.	Apr. - June	June		June - Aug.		
8-13	-	-	92.1 (51)	90.8 (412)	96.7 (91)	-	92.9 (183)	3.86	0.27
≥14	-	-	78.4 (74)	82.2 (169)	82.1 (28)	-	69.1 (55)	4.53	0.21
					1961				
	Jan. - Mar.	Mar. - Apr.							
5	24.4 (41)	14.8 (27)	-	-	-	-	-	0.42	0.50
6	82.9 (41)	66.7 (15)	-	-	-	-	-	0.89	0.36
7	77.4 (62)	70.0 (29)	-	-	-	-	-	0.36	0.56
8-13	88.8 (410)	88.8 (116)	-	-	-	-	-	0	>0.99
≥14	77.5 (178)	88.2 (51)	-	-	-	-	-	0.02	0.90
					1962				
					June - Sept.	June - Sept.	July - Sept.		
5	-	-	-	-	16.7 (30)	16.2 (37)	37.5 (56)	6.98	0.03
6	-	-	-	-	56.3 (16)	45.0 (20)	58.3 (36)	1.13	0.95
7	-	-	-	-	79.4 (34)	85.0 (20)	89.7 (39)	1.52	0.48
8-13	-	-	-	-	83.9 (118)	88.9 (153)	91.8 (244)	5.16	0.08
≥14	-	-	-	-	77.1 (35)	73.5 (102)	83.5 (133)	3.49	0.18
					1964				
	Apr. - May						July - Sept.		
5	18.5 (27)	-	-	-	-	-	43.9 (57)	4.08	0.04
6	65.2 (23)	-	-	-	-	-	79.2 (53)	1.02	0.32
8-13	84.9 (73)	-	-	-	-	-	85.6 (174)	>0.001	>0.98
≥14	65.2 (69)	-	-	-	-	-	65.2 (89)	0	>0.99

Table 46.--Pregnancy rates, by area and month of collection, and chi-square value for tests of pregnancy rates, between years, 1958-66

[Sample sizes are shown in parentheses]

Age Years	Year 1958	1959	1960	1961	1962	1963	1964	1965	1966	Chi-square	P
					California						
	Feb.-Apr.	Jan.-Apr.		Jan.-Mar.			Apr.-May	Apr.-May	Jan.-Mar.		
5	60.5 (38)	60.0 (95)	-	24.4 (41)	-	-	18.5 (27)	13.3 (15)	27.3 (66)	40.46	<0.001
6	92.5 (40)	82.2 (107)		82.9 (41)	-	-	65.2 (23)	52.6 (19)	71.4 (35)	17.22	<0.01
7	95.3 (43)	80.5 (128)	-	77.4 (62)	-	-	-	-	78.3 (46)	6.39	0.10
8-13	93.8 (226)	89.7 (485)	-	88.8 (410)	-	-	84.9 (73)	81.6 (76)	88.2 (127)	11.31	0.05
≥14	92.1 (76)	85.1 (288)	-	77.5 (178)	-	-	65.2 (69)	68.0 (50)	75.0 (44)	27.05	<0.001
					Southeast Alaska						
	Feb.-Apr.		Mar.								
8-13	91.9 (74)	-	92.1 (51)	-	-	-	-	-	-	<0.001	>0.98
≥14	84.3 (115)	-	78.4 (74)	-	-	-	-	-	-	0.72	0.41
					Gulf of Alaska						
	May-June		Apr.-May								
7	94.1 (34)	-	83.9 (31)	-	-	-	-	-	-	0.85	0.37
8-13	88.2 (228)	-	90.8 (412)	-	-	-	-	-	-	0.83	0.38
≥14	84.5 (71)	-	82.2 (169)	-	-	-	-	-	-	0.06	0.80
					Western Alaska						
	June		June		May-Sept.						
8-13	87.8 (49)	-	96.7 (91)	-	83.9 (118)	-	-	-	-	8.46	0.01
≥14	-	-	82.1 (28)	-	77.1 (35)	-	-	-	-	0.03	0.87
					Bering Sea						
			June-Aug.		June-Oct.	July-Sept.	July-Sept.				
5	-	-	57.9 (38)	-	37.5 (56)	44.4 (162)	43.9 (57)	-	-	3.88	0.28
6	-	-	86.2 (29)	-	58.3 (36)	74.2 (89)	79.2 (53)	-	-	7.61	0.06
7	-	-	88.5 (26)	-	89.7 (39)	89.5 (76)	75.8 (33)	-	-	4.30	0.23
8-13	-	-	92.9 (183)	-	91.8 (244)	92.4 (476)	85.6 (174)	-	-	8.42	0.04
≥14	-	-	69.1 (55)	-	83.5 (133)	77.1 (240)	65.2 (89)	-	-	11.31	0.01

Table 47. --Number of female seals collected pelagically by the United States in the eastern Pacific and (in parentheses) percentage pregnant, 1958-68

Age	Year											1958-68 combined
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	
Years	Number											
3	39 (2.6)	43 (0.0)	18 (0.0)	84 (0.0)	93 (1.1)	53 (0.0)	74 (0.0)	51 (0.0)	30 (0.0)	10 (0.0)	35 (0.0)	530 (0.4)
4	42 (2.4)	93 (6.4)	36 (2.8)	96 (1.0)	140 (2.9)	113 (7.1)	62 (1.6)	73 (0.0)	68 (1.5)	9 (0.0)	95 (5.3)	827 (3.4)
5	70 (45.7)	114 (56.1)	55 (49.1)	68 (20.6)	123 (26.0)	162 (43.8)	84 (35.7)	23 (26.1)	66 (27.3)	9 (44.4)	37 (37.8)	811 (38.5)
6	99 (80.8)	118 (77.1)	45 (80.0)	62 (75.8)	72 (54.2)	90 (74.4)	81 (75.3)	37 (56.8)	35 (71.4)	20 (60.0)	47 (76.6)	706 (72.9)
7	103 (89.3)	143 (76.2)	66 (78.8)	95 (75.8)	93 (84.9)	77 (88.3)	44 (77.3)	24 (79.2)	46 (78.3)	7 (71.4)	69 (72.5)	767 (80.3)
8	102 (89.2)	164 (86.6)	105 (85.7)	107 (79.4)	98 (89.8)	87 (97.7)	46 (84.8)	33 (84.8)	43 (79.1)	7 (85.7)	38 (78.9)	830 (86.5)
9	81 (96.3)	108 (88.9)	144 (92.4)	114 (93.9)	73 (83.6)	60 (85.0)	30 (83.3)	17 (70.6)	20 (100.0)	12 (100.0)	40 (82.5)	699 (89.8)
10	97 (87.6)	96 (85.4)	129 (91.5)	112 (93.8)	100 (89.0)	72 (93.1)	49 (87.8)	10 (90.0)	13 (84.6)	11 (90.9)	40 (77.5)	729 (89.2)
11	113 (92.0)	98 (89.8)	136 (91.2)	82 (89.0)	91 (89.0)	88 (94.3)	42 (85.7)	18 (83.3)	23 (78.3)	4 (100.0)	39 (76.9)	734 (89.4)
12	134 (82.0)	76 (88.2)	106 (90.6)	71 (93.0)	97 (89.7)	92 (92.4)	51 (84.3)	15 (73.3)	16 (100.0)	3 (66.7)	40 (90.0)	701 (88.3)
13	110 (82.7)	56 (89.3)	120 (87.5)	76 (82.9)	58 (94.8)	76 (90.8)	33 (84.8)	8 (100.0)	12 (100.0)	3 (100.0)	24 (83.3)	576 (87.5)
14	92 (81.5)	70 (84.3)	107 (80.4)	67 (92.5)	65 (87.7)	57 (80.7)	38 (76.3)	10 (80.0)	14 (85.7)	1 (100.0)	26 (80.8)	547 (83.4)
15	71 (78.9)	87 (88.5)	67 (83.6)	68 (79.4)	53 (81.1)	75 (85.3)	41 (65.9)	14 (78.6)	15 (93.3)	3 (66.7)	30 (86.7)	524 (82.1)
16	56 (78.6)	69 (75.4)	53 (71.7)	55 (85.5)	50 (82.0)	45 (82.2)	22 (72.7)	12 (83.3)	5 (80.0)	6 (100.0)	26 (96.2)	399 (80.2)
17	36 (56.6)	36 (80.6)	46 (67.4)	24 (62.5)	44 (72.7)	28 (71.4)	21 (61.9)	10 (80.0)	5 (40.0)	2 (0.0)	21 (81.0)	273 (68.5)
18	22 (59.1)	27 (85.2)	23 (82.6)	25 (64.0)	25 (72.0)	12 (58.3)	20 (60.0)	8 (37.5)	- -	- -	11 (72.7)	173 (68.8)
19	14 (28.6)	16 (81.3)	19 (57.9)	10 (50.0)	15 (60.0)	5 (60.0)	7 (57.1)	2 (0.0)	3 (33.3)	- -	10 (60.0)	101 (55.4)
20	3 (33.3)	5 (40.0)	6 (16.7)	7 (100.0)	11 (72.7)	11 (45.5)	10 (20.0)	2 (0.0)	1 (0.0)	1 (0.0)	7 (71.4)	64 (48.4)
21	1 (100.0)	7 (85.7)	6 (50.0)	2 (50.0)	3 (100.0)	4 (50.0)	- -	1 (0.0)	1 (0.0)	- -	3 (33.3)	28 (60.7)
22	1 (0.0)	5 (40.0)	- -	- -	3 (66.7)	- -	- -	- -	- -	1 (0.0)	3 (0.0)	13 (30.8)
23	- -	1 (0.0)	1 (0.0)	1 (0.0)	- -	2 (0.0)	1 (100.0)	1 (0.0)	- -	- -	1 (0.0)	8 (12.5)
24	- -	1 (0.0)	1 (0.0)	1 (0.0)	1 (0.0)	- -	- -	- -	- -	- -	- -	4 (0.0)
26	- -	1 (0.0)	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 (0.0)
Total	1,286 (76.1)	1,434 (73.8)	1,289 (79.7)	1,227 (68.5)	1,308 (63.4)	1,209 (69.3)	756 (58.7)	369 (45.8)	416 (52.3)	109 (61.5)	642 (61.4)	10,045 (68.4)
6-26 years	1,135 (83.3)	1,184 (83.4)	1,180 (84.4)	979 (84.3)	952 (83.2)	881 (86.0)	536 (77.0)	222 (73.4)	252 (81.3)	81 (77.8)	475 (78.9)	7,877 (82.9)

Table 48. --Stomach contents of fur seals collected pelagically by the United States off Washington, 1967-68

[T = trace (<5 cc.). Trace counts are included in frequency counts.]

Food	Autumn November			Winter December-February			November-February		
	Volume		Frequency	Volume		Frequency	Volume		Frequency
	Cc.	Percent	Number	Cc.	Percent	Number	Cc.	Percent	Number
Fish									
Lampetra tridentata	-	-	-	325	0.4	2	325	0.4	2
Alosa sapidissima	T	0.0	1	1,270	1.6	8	1,270	1.6	9
Clupea harengus pallasi	-	-	-	2,005	2.5	16	2,005	2.5	16
Engraulis mordax	-	-	-	12,663	15.9	35	12,663	15.9	35
Salmonidae	T	0.0	1	25,324	31.7	59	25,324	31.7	60
Osmeridae	-	-	-	165	0.2	7	165	0.2	7
Mallotus villosus	-	-	-	7,749	9.7	33	7,749	9.7	33
Thaleichthys pacificus	-	-	-	9,275	11.7	24	9,275	11.7	24
Myctophidae	-	-	-	550	0.7	4	550	0.7	4
Gadidae	-	-	-	35	0.0	1	35	0.0	1
Merluccius productus	-	-	-	2,636	3.3	9	2,636	3.3	9
Sebastodes spp.	-	-	-	11,398	14.3	10	11,398	14.3	10
Anoplopoma fimbria	-	-	-	4,071	5.1	22	4,071	5.1	22
Pleuronectidae	-	-	-	1,266	1.6	5	1,266	1.6	5
Unidentified	T	0.0	1	28	0.0	82	28	0.0	83
Squid									
Loligo opalescens	T	0.0	1	48	0.0	16	48	0.0	17
Onychoteuthis sp.	T	0.0	1	T	0.0	6	T	0.0	7
Gonatidae	T	0.0	1	T	0.0	39	T	0.0	40
Gonatus fabricii	-	-	-	109	0.1	15	109	0.1	15
Gonatus magister	-	-	-	824	1.0	2	824	1.0	2
Chiroteuthis veranyi	-	-	-	T	0.0	1	T	0.0	1
Unidentified	-	-	-	T	0.0	4	T	0.0	4
Bird (feather)	T	0.0	1	T	0.0	1	T	0.0	2
Pebbles	-	-	-	T	0.0	4	T	0.0	4
Inorganic material	-	-	-	T	0.0	1	T	0.0	1
Organic material	-	-	-	T	0.0	2	T	0.0	2
Crustacea	-	-	-	139	0.2	6	139	0.2	6
Gastropoda	T	0.0	1	T	0.0	1	T	0.0	2
Parasitic copepod	-	-	-	T	0.0	7	T	0.0	7
Total	-			79,880			79,880		
Stomachs with food	251								
Stomachs empty	123								

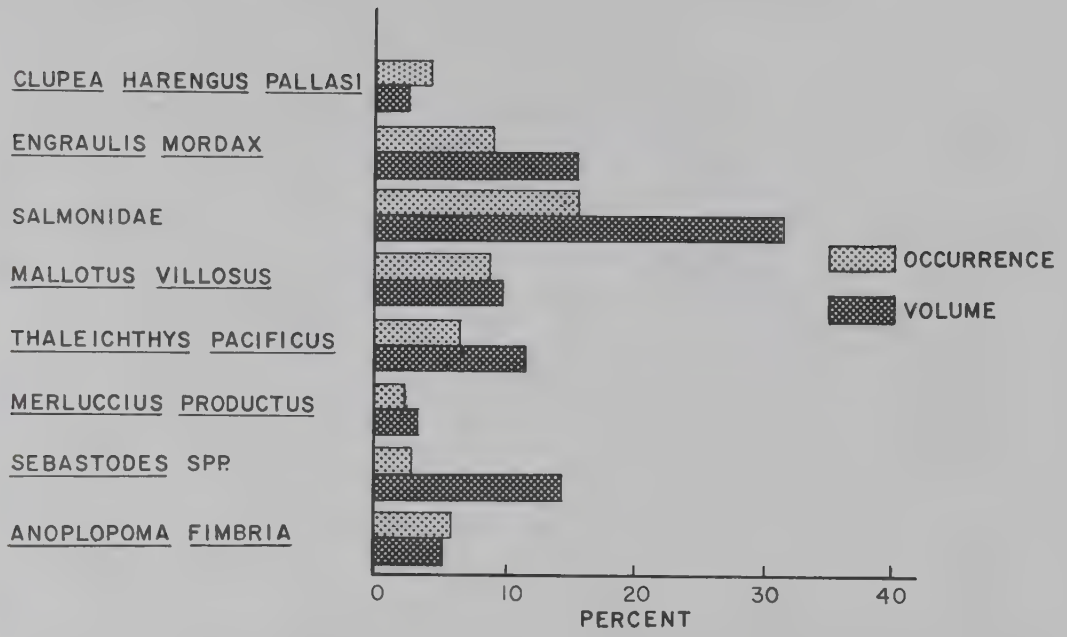

Figure 21.--Percentage volume and percentage occurrence of principal food species in fur seal stomachs collected off Washington, 1967-68

capelin, Mallotus villosus, constituted 83.3 percent of the total food volume (fig. 21). Salmon (60 occurrences) was the leading food, contributing 31.7 percent of the total food volume. Fur seals ate all five species of Pacific salmon (pink, Oncorhynchus gorbuscha; chum, O. keta; coho, O. kisutch; sockeye, O. nerka; and chinook, O. tshawytscha). The salmon were immature with no ocean growth on the scales.[7] Figures 22 to 25 show species with frequency of occurrence greater than 10.

Off Alaska in May-August 1968, 323 (71 percent) of 456 stomachs contained food (tables 49-53). Walleye pollock, Theragra chalcogrammus; squids; and Atka mackerel, Pleurogrammus monopterygius, constituted 84.9 percent of the total food volume (fig. 26). Walleye pollock was the leading species eaten by seals in three of four areas surveyed in Alaska and contributed 37.8 percent of the total volume. Three species of Pacific salmon (pink, chum, and sockeye) in stomachs of fur seals taken in Alaska waters were mature and contributed 5.1 percent of the total food volume (19 occurrences). Two seals were taken alongside a Bureau of Commercial Fisheries salmon gill net research vessel as the net was being hauled. The stomach of one contained a mature 5-year-old chum salmon, Atka mackeral, and squids. The other stomach contained walleye pollock, Atka mackeral, and squids. Figures 27 to 32 show species with frequency of occurrence greater than 10.

The feeding habits of yearling seals (1967 year class) during their first winter at sea were studied by examining stomach contents and fecal material from a sample of 60 collected in January and February 1968 off Washington. Remains of fish vertebrae and otoliths were in 97 percent of the fecal samples, whereas, 20 of the corresponding 60 stomachs were empty. Remains of an eye lens, a bird feather, crustaceans, insects, pebbles, a lamprey, and squid beaks were also found in the fecal samples.

RELATION OF FEEDING HABITS TO COMMERCIAL FISHERIES

The feeding habits of fur seals seem to be governed by abundance and availability of food. Salmon (Oncorhynchus spp.) were the most valuable commercial fish eaten by fur seals collected off Washington (60 occurrences) and Alaska (19 occurrences) in 1967-68. Salmon formed a larger proportion of the diet of seals off Washington in 1968 than in any previous collection. Other commercially important fish available off Washington are rockfish and eulachon. In Alaska, walleye pollock are caught by foreign fleets for minced meat and fish meal products. Squids, an important food of fur seals, are not fished commercially by the United States off Washington or in Alaska waters.

[7]Kenneth H. Mosher and Gunnar Safsten, Bureau of Commercial Fisheries Biological Laboratory, Seattle, Wash., determined ages from the salmon scales.

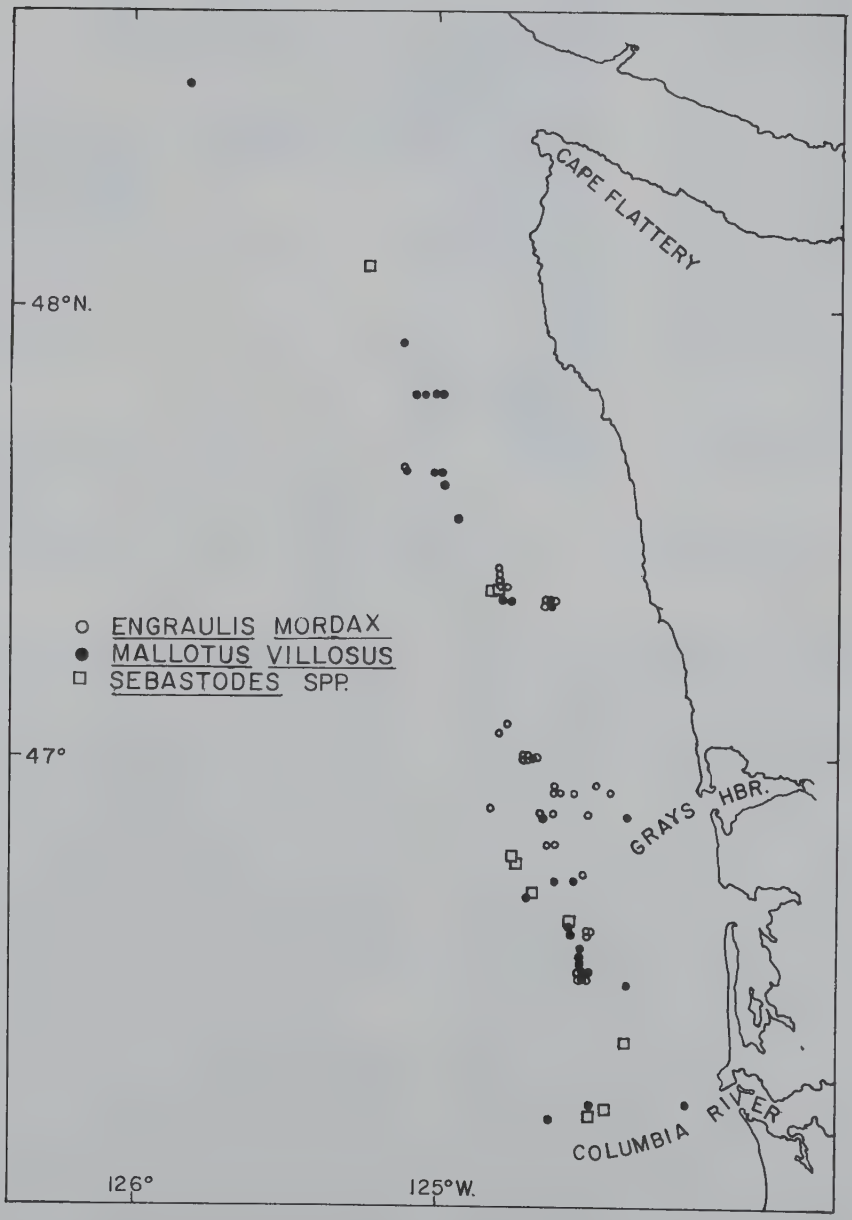

Figure 22.--Locations where fur seal stomachs collected off Washington in November-December 1967 and January-February 1968 contained Engraulis mordax (35 occurrences); Mallotus villosus (33 occurrences); and Sebastodes spp. (10 occurrences).

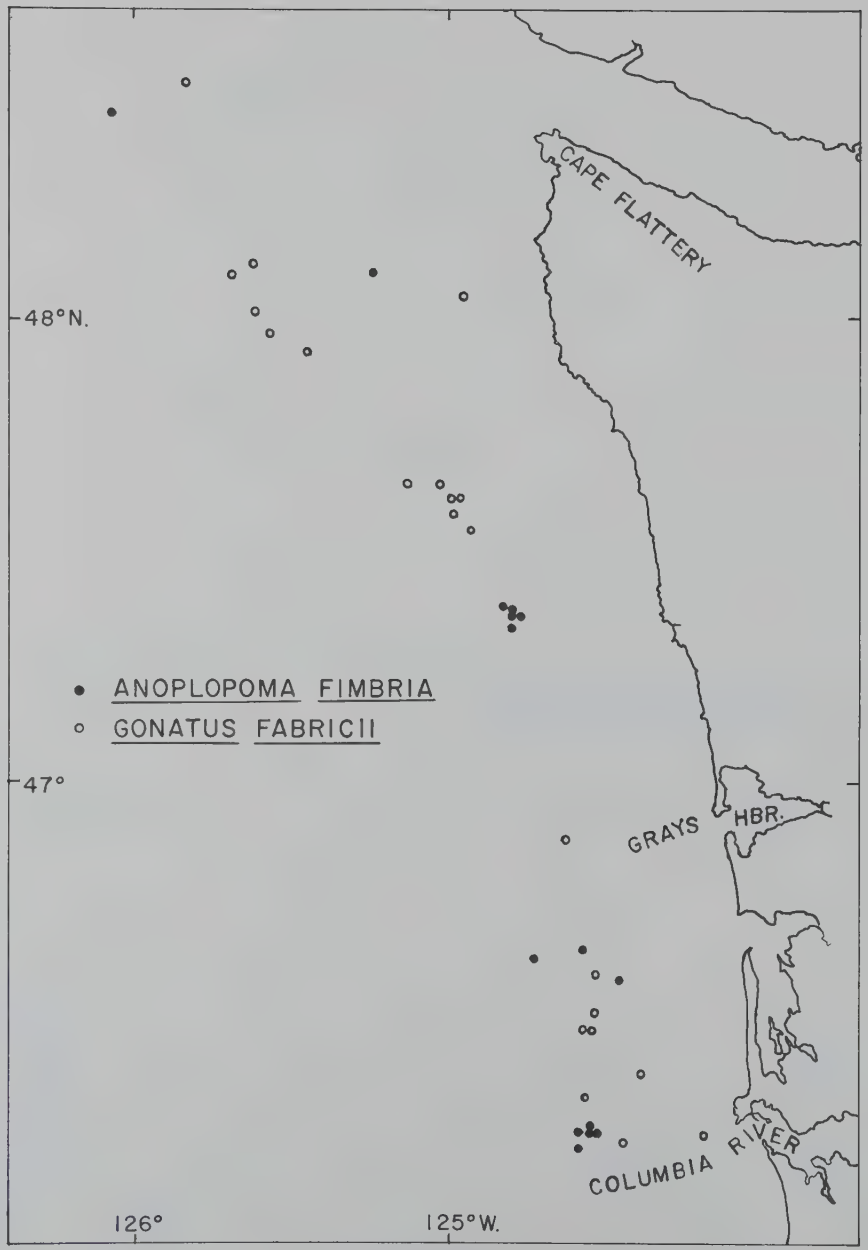

Figure 23.--Locations where fur seal stomachs collected off Washington in November-December 1967 and January-February 1968 contained Anoplopoma fimbria (22 occurrences) and Gonatus fabricii (15 occurrences).

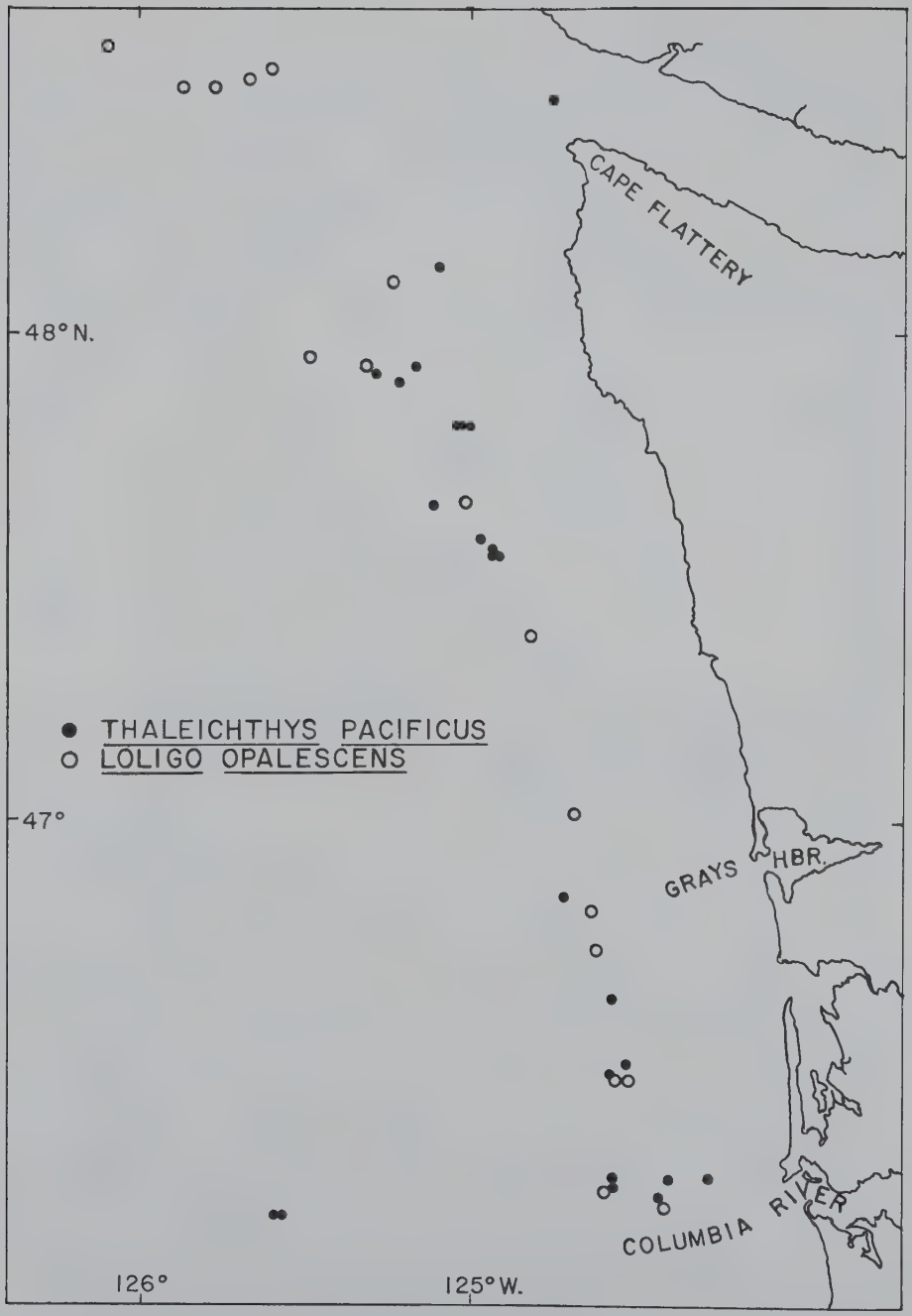

Figure 24.--Locations where fur seal stomachs collected off Washington in November-December 1967 and January-February 1968 contained Thaleichthys pacificus (24 occurrences) and Loligo opalescens (17 occurrences).

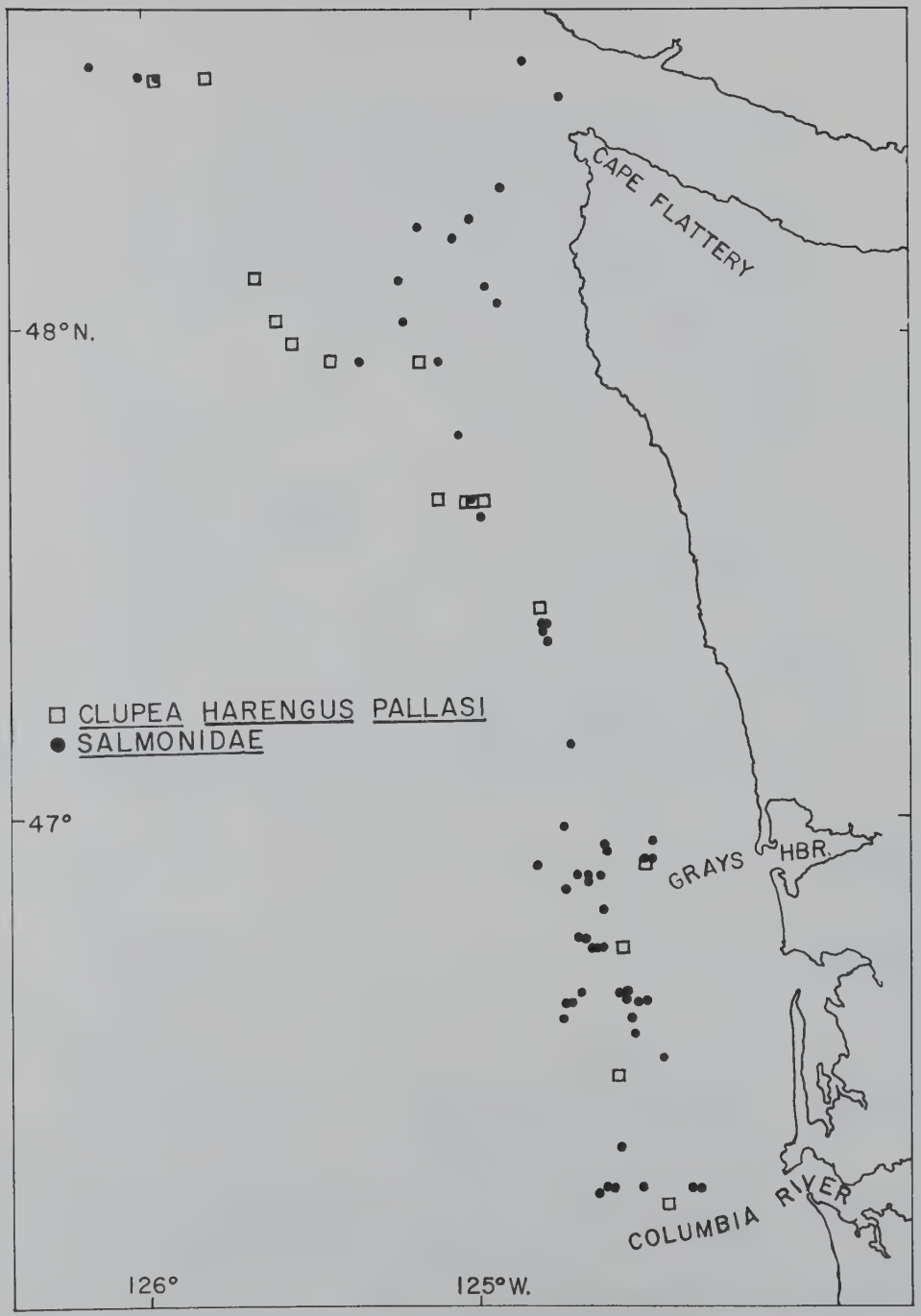

Figure 25.--Locations where fur seal stomachs collected off Washington in November-December 1967 and January-February 1968 contained Clupea harengus pallasi (16 occurrences), and Salmonidae (60 occurrences).

Table 49. --Stomach contents of fur seals collected pelagically by the United States off Southeastern Alaska, 1968

[T = trace (<5 cc.); counts are included in frequency counts]

Food	Spring		
	May		
	Volume		Frequency
	Cc.	Percent	Number
Fish			
Theragra chalcogrammus	20	100.0	1
Squid			
Gonatidae	T	0.0	1
Total	20	-	-
Stomachs with food	1		
Stomachs empty	2		

Table 50. --Stomach contents of fur seals collected pelagically by the United States in the Gulf of Alaska, 1968

[T = trace (<5 cc.); counts are included in frequency counts]

Food	Spring			Summer			May-August		
	May			June-August					
	Volume		Frequency	Volume		Frequency	Volume		Frequency
	Cc.	Percent	Number	Cc.	Percent	Number	Cc.	Percent	Number
Fish									
Osmeridae	T	0.0	2	-	-	-	T	0.0	2
Mallotus villosus	7,415	14.7	14	-	-	-	7,415	14.6	14
Myctophidae	T	0.0	1	-	-	-	T	0.0	1
Cololabis saira	127	0.3	1	-	-	-	127	0.2	1
Gadidae	T	0.0	1	-	-	-	T	0.0	1
Theragra chalcogrammus	14,725	29.2	13	-	-	-	14,725	29.0	13
Trichodon trichodon	70	0.1	1	--	-	-	70	0.1	1
Ammodytes hexapterus	825	1.6	2	-	-	-	825	1.6	2
Unidentified	668	1.3	15	T	0.0	1	668	1.3	16
Squid									
Gonatidae	T	0.0	46	10	0.0	2	10	0.0	48
Gonatus fabricii	233	0.5	9	T	0.0	1	233	0.5	10
Gonatus magister	8,804	17.4	21	-	-	-	8,804	17.4	21
Gonatopsis borealis	17,613	34.9	27	235	100.0	1	17,848	35.2	28
Unidentified	T	0.0	2	T	0.0	1	T	0.0	3
Pebbles	T	0.0	2	T	0.0	1	T	0.0	3
Parasitic copepods	T	0.0	4	-	-	-	T	0.0	4
Total	50,480			245			50,725		
Stomachs with food	81								
Stomachs empty	23								

Table 51.--Stomach contents of fur seals collected pelagically by the United States off western Alaska, 1968

[T = trace (<5 cc.); counts are included in frequency counts]

Food	Summer June-August		
	Volume		Frequency
	Cc.	Percent	Number
Fish			
Salmonidae	6,602	13.8	11
Osmeridae	T	0.0	2
Mallotus villosus	3,275	6.9	12
Gadidae	T	0.0	1
Gadus macrocephalus[1/]	T	0.0	1
Theragra chalcogrammus	6,469	13.5	15
Pleurogrammus monopterygius	26,844	56.1	34
Ammodytes hexapterus	325	0.7	3
Unidentified	85	0.2	14
Squid			
Gonatidae	256	0.5	67
Gonatus fabricii	58	0.1	9
Gonatus magister	736	1.5	2
Gonatopsis borealis	3,047	6.4	10
Unidentified	T	0.0	4
Bird (feather)	125	0.3	2
Pebbles	T	0.0	3
Organic material	T	0.0	1
Isopoda	T	0.0	6
Crustacea	T	0.0	1
Gastropoda	T	0.0	5
Parasitic copepod	T	0.0	2
Total	47,822		
Stomachs with food	107		
Stomachs empty	40		

1/ Otoliths identified by John E. Fitch, California Department of Fish and Game.

Table 52.--Stomach contents of fur seals collected pelagically by the United States in the Bering Sea, 1968

[T = trace (<5 cc.); counts are included in frequency counts]

Food	Summer July-August		
	Volume		Frequency
	Cc.	Percent	Number
Fish			
Salmonidae	2,130	3.0	8
Mallotus villosus	1,854	2.6	5
Bathylagidae	1,898	2.7	13
Gadidae	25	0.0	4
Gadus macrocephalus 1/	T	0.0	4
Theragra chalcogrammus	43,107	60.4	34
Pleurogrammus monopterygius	935	1.3	4
Ammodytes hexapterus	250	0.3	1
Unidentified	15	0.0	10
Squid			
Gonatidae	225	0.3	90
Gonatus fabricii	166	0.2	37
Gonatus magister	12,516	17.5	14
Gonatopsis borealis	7,474	10.5	32
Unidentified	835	1.2	5
Bird	T	0.0	1
Pebbles	T	0.0	5
Total	71,430		
Stomachs with food	133		
Stomachs empty	68		

1/ Otoliths identified by John E. Fitch, California Department of Fish and Game.

Table 53.--Total stomach contents of fur seals collected pelagically by the United States off Alaska, 1968.

[T = trace (<5 cc.); counts are included in frequency counts]

Food	Spring and Summer May-August		
	Volume		Frequency
	Cc.	Percent	Number
Fish			
Salmonidae	8,732	5.1	19
Osmeridae	T	0.0	4
Mallotus villosus	12,544	7.4	31
Bathylagidae	1,898	1.1	13
Myctophidae	T	0.0	1
Cololabis saira	127	0.1	1
Gadidae	25	0.0	6
Gadus macrocephalus[1/]	T	0.0	5
Theragra chalcogrammus	64,321	37.8	63
Pleurogrammus monopterygius	27,779	16.3	38
Trichodon trichodon	70	0.0	1
Ammodytes hexapterus	1,400	0.8	6
Unidentified	768	0.5	40
Squid			
Gonatidae	491	0.3	206
Gonatus fabricii	457	0.3	55
Gonatus magister	22,056	13.0	37
Gonatopsis borealis	28,369	16.7	70
Unidentified	835	0.5	12
Bird	125	0.1	3
Pebbles	T	0.0	11
Organic material	T	0.0	1
Isopoda	T	0.0	6
Crustacea	T	0.0	1
Gastropoda	T	0.0	5
Parasitic copepod	T	0.0	6
Total	169,997		
Stomachs with food	323		
Stomachs empty	133		

[1/] Otoliths identified by John E. Fitch, California Department of Fish and Game.

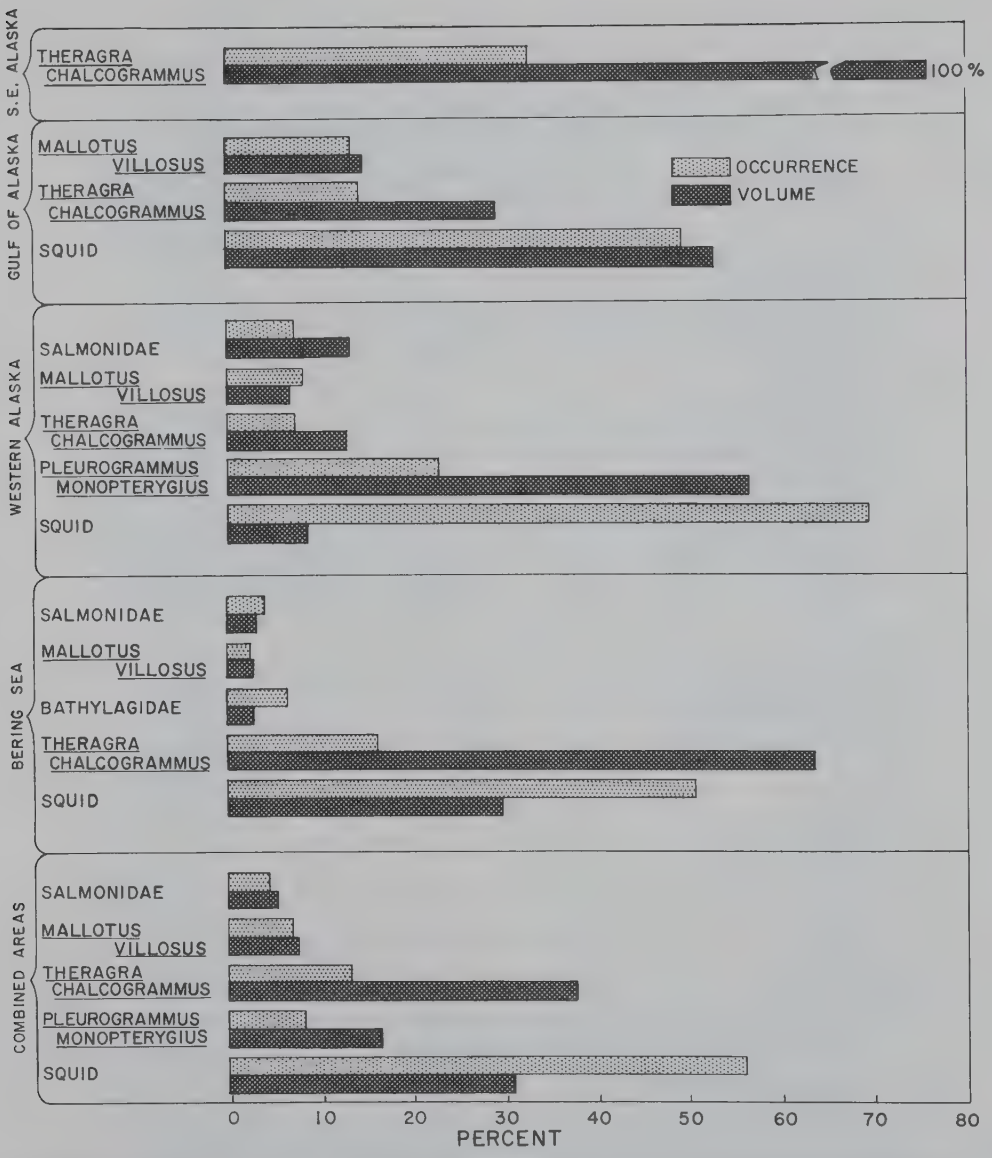

Figure 26.--Percentage volume and percentage occurrence of principal food species in fur seal stomachs collected off Alaska in 1968.

Figure 27.--Locations where fur seal stomachs collected off western Alaska and in the Bering Sea in 1968 contained Salmonidae (11 occurrences) and Gonatus magister (14 occurrences).

Figure 28.--Locations where fur seal stomachs collected off western Alaska and in the Bering Sea in 1968 contained Mallotus villosus (12 occurrences) and Gonatopsis borealis (42 occurrences).

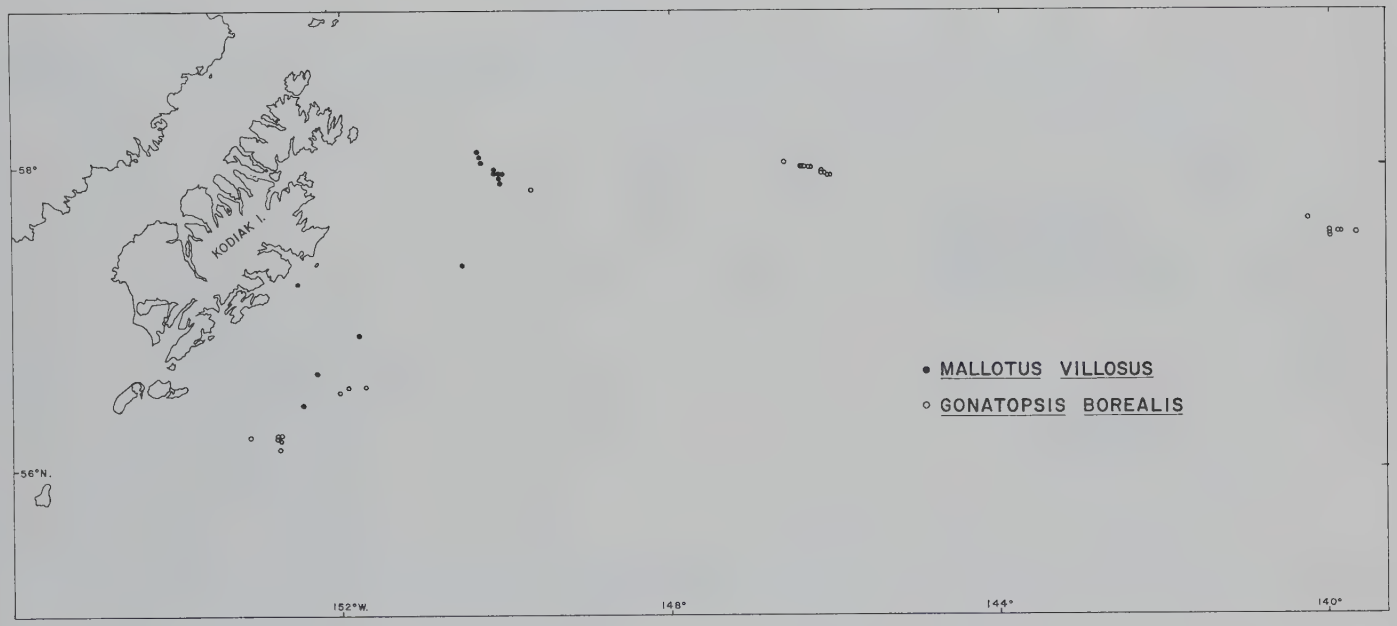

Figure 29.--Locations where fur seal stomachs collected in Gulf of Alaska in 1968 contained Mallotus villosus (14 occurrences) and Gonatopsis borealis (28 occurrences).

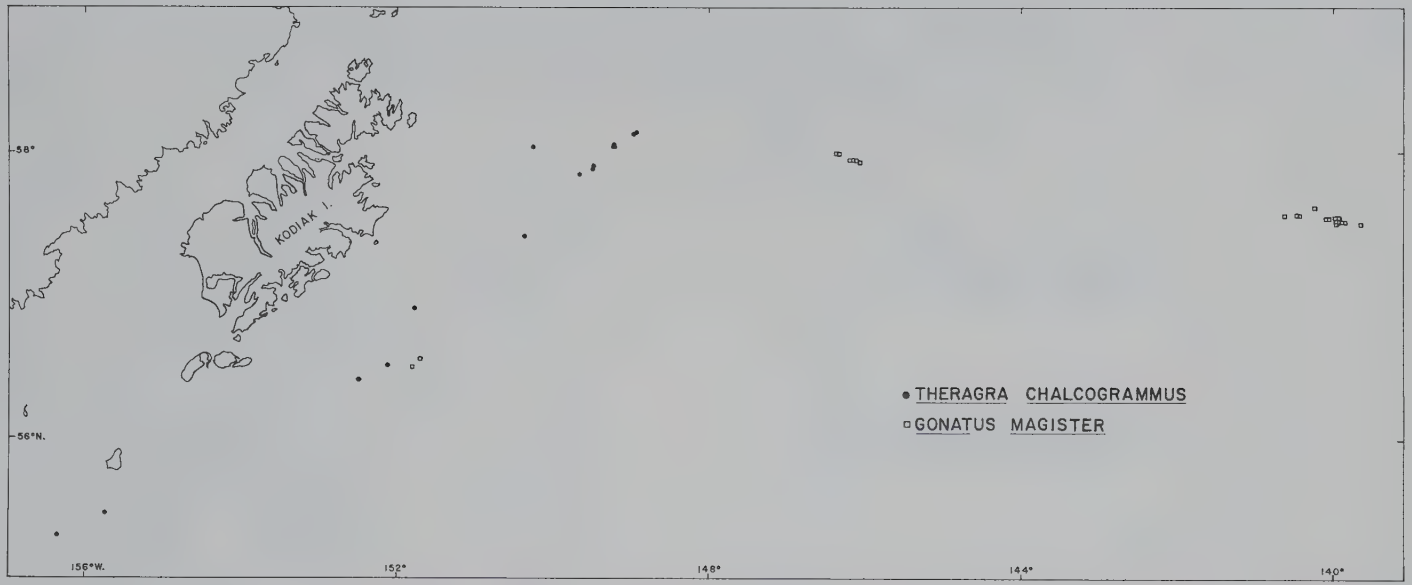

Figure 30.--Locations where fur seal stomachs collected in Gulf of Alaska in 1968 contained Theragra chalcogrammus (15 occurrences) and Gonatus magister (21 occurrences).

Figure 31.--Locations where fur seal stomachs collected off western Alaska and in the Bering Sea in 1968 contained Bathylagidae (13 occurrences) and Theragra chalcogrammus (44 occurrences).

Figure 32.--Locations where fur seal stomachs collected off western Alaska and in the Bering Sea in 1968 contained Pleurogrammus monopterygius (34 occurrences) and Gonatus fabricii (37 occurrences).

Considering the volume and frequency of occurrence of commercially important fishes found in fur seal stomachs and our limited knowledge of the ocean environment and its ecology, we believe the effects of predation on food species with economic value are impossible to assess with any degree of confidence.

SUMMARY

Pelagic research in 1968 was conducted for continuing studies of the distribution, feeding habits, migration, and pregnancy rates of fur seals.

The M/V Tonquin was chartered for research off Washington in November-December 1967 and January-February 1968. The M/V New St. Joseph was chartered for research in Alaska waters from May through August 1968.

Of 1,078 seals sighted off Washington, 374 were collected, 39 were wounded and lost, and 26 were killed and lost. Of 1,509 seals sighted in Alaska waters, 456 were collected, 27 were wounded and lost, and 78 were killed and lost. About 50 percent of the females taken were 1 to 7 years of age.

Seventy-four yearlings (1967 year class) were taken in January and February for continuing studies of these animals during their first year of life, a period when fur seals suffer the greatest mortality.

Thirty-eight tagged or marked seals were collected.

Five primiparous 4-year-old females were the youngest and one 21-year-old multiparous female was the oldest among pregnant seals taken.

Off Washington, salmon, anchovy, rockfish, eulachon, and capelin constituted 83.3 percent of the total food volume. Salmon (60 occurrences) was the leading species and contributed 31.7 percent of the total food volume.

Walleye pollock, squids, and Atka mackerel constituted 84.9 percent of the total food volume of seals from Alaska waters. Walleye pollock was the leading species in three of four areas surveyed and contributed 37.8 percent of the total food volume.

Sixty fecal samples were compared with corresponding stomach contents for a study of the feeding habits of yearling seals. Ninety-seven percent of the samples contained the remains of fish, and 33 percent of the corresponding stomachs were empty.

LITERATURE CITED

CHAPMAN, DOUGLAS G., and ANCEL M. JOHNSON.
1968. Estimation of fur seal pup populations by randomized sampling. Trans. Amer. Fish. Soc., 97: 264-270.

FISCUS, CLIFFORD H., GARY A. BAINES, and FORD WILKE.
1964. Pelagic fur seal investigations, Alaskan waters, 1962. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 475, iii+ 59 pp.

FISCUS, CLIFFORD. H., and HIROSHI KAJIMURA.
1967. Pelagic fur seal investigations, 1965. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 537, iv + 42 pp.

JOHNSON, ANCEL M.
1968. Annual mortality of territorial male fur seals and its management significance. J. Wildl. Manage. 32: 94-99.

MARINE MAMMAL BIOLOGICAL LABORATORY
1969 Fur seal investigations, 1966. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 584, vii + 123 pp.
1970. Fur seal investigations, 1967. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 597,

STANDING SCIENTIFIC COMMITTEE OF THE NORTH PACIFIC FUR SEAL COMMISSION.
1963. Glossary of terms used in fur seal research and management. U.S. Fish Wildl. Serv., Fish Leafl. 546, 9 pp.

APPENDIX A

Table A-1. --Age classification of male seals killed on St. Paul Island, 26 June to 2 August 1968

Date	Rookery[1]	Males killed	Tooth sample	Seals in each age group of sample					Estimated seals killed from each age group				
				2	3	4	5	6	2	3	4	5	6
		Number	Number	Percent					Number				
June													
26	TZR	996	186	0.5	27.4	64.6	7.0	0.5	5	273	643	70	5
27	NEP(east)	575	109	0.9	22.0	62.4	12.9	1.8	5	126	360	74	10
27	NEP(west)	251	39	2.6	15.4	48.7	33.3	-	6	39	122	84	-
27	POL	389	79	-	19.0	72.2	7.6	1.2	-	74	281	29	5
28	REEF	1,021	177	-	19.2	66.1	14.1	0.6	-	196	675	144	6
28	L-K	150	29	-	17.2	69.0	13.8	-	-	26	104	20	-
July													
1	ZAP	732	140	-	29.3	62.1	7.1	1.5	-	214	455	52	11
1	POL	160	33	-	36.4	51.5	12.1	-	-	58	82	20	-
2	NEP(east)	408	80	1.2	33.8	55.0	10.0	-	5	138	224	41	-
2	NEP(west)	359	61	-	31.2	60.6	8.2	-	-	112	218	29	-
2	L-K	42	11	-	18.2	72.7	9.1	-	-	8	30	4	-
3	REEF	442	123	-	35.8	52.0	11.4	0.8	-	158	230	50	4
3	TZR	670	91	1.1	33.0	58.2	6.6	1.1	7	222	390	44	7
5	ZAP	276	55	3.6	34.6	54.5	7.3	-	10	95	151	20	-
5	POL	114	22	-	27.3	63.6	9.1	-	-	31	73	10	-
6	NEP(east)	524	109	0.9	50.5	44.0	3.7	0.9	5	264	231	19	5
6	NEP(west)	302	58	3.4	41.4	48.3	6.9	-	10	125	146	21	-
8	TZR	1,384	257	2.7	54.5	38.9	3.9	-	37	755	538	54	-
9	POL	281	52	-	21.2	75.0	1.9	1.9	-	60	211	5	5
9	REEF	422	84	-	46.4	48.8	4.8	-	-	196	206	20	-
10	ZAP	988	194	1.5	46.9	46.4	5.2	-	15	463	459	51	-
10	L-K	139	28	-	35.7	60.7	3.6	-	-	49	85	5	-
11	NEP(east)	393	92	3.3	51.1	41.3	3.2	1.1	13	201	162	13	4
11	NEP(west)	208	41	-	51.2	43.9	4.9	-	-	107	91	10	-
12	REEF	358	70	1.4	50.0	41.5	7.1	-	5	179	149	25	-
12	TZR	139	28	-	50.0	42.8	7.2	-	-	70	59	10	-
13	TZR	894	207	1.0	55.5	38.2	5.3	-	9	496	342	47	-
15	ZAP	2,227	439	2.5	57.9	35.8	3.6	0.2	56	1,290	797	80	4
16	NEP(west)	130	22	-	59.1	36.4	0.5	-	-	77	47	6	-
16	POL	709	171	1.8	57.3	37.4	3.5	-	13	406	265	25	-
17	NEP(east)	774	141	5.0	60.3	31.9	2.8	-	39	467	247	21	-
17	TZR	365	71	1.4	69.0	26.8	1.4	1.4	5	252	98	5	5
18	REEF	1,249	287	3.8	60.6	33.8	1.8	-	47	757	422	23	-
18	L-K	857	184	3.8	68.5	27.2	0.5	-	33	587	233	4	-
19	TZR	318	65	1.5	70.8	24.6	3.1	-	5	225	78	10	-
19	ZAP	603	104	1.0	49.0	44.2	5.8	-	6	295	267	35	-
20	TZR	454	85	2.4	51.8	38.8	4.6	2.4	11	235	176	21	11
20	POL	131	14	-	28.6	64.3	7.1	-	-	38	84	9	-
22	NEP(east)	1,399	203	5.4	64.5	28.1	2.0	-	76	902	393	28	-
22	NEP(west)	384	70	1.4	65.7	30.0	2.9	-	6	252	115	11	-
23	REEF	1,255	252	8.3	60.3	30.2	1.2	-	104	757	379	15	-
23	L-K	410	79	11.4	59.5	27.8	1.3	-	47	244	114	5	-
24	ZAP	756	151	5.3	57.6	35.8	1.3	-	40	435	271	10	-
25	TZR	1,443	288	1.0	62.5	31.3	4.9	0.3	14	902	452	71	4
26	NEP(east)	325	65	15.4	67.7	16.9	-	-	50	220	55	-	-
26	NEP(west)	518	106	8.5	63.2	24.5	3.8	-	44	327	127	20	-
27	POL	289	54	5.6	57.4	35.2	1.8	-	16	166	102	5	-
27	L-K	415	77	10.4	55.8	31.2	2.6	-	43	232	129	11	-
29	REEF	1,470	268	4.5	63.0	29.1	3.0	0.4	66	926	428	44	6
30	TZR	1,665	282	8.9	68.4	19.9	2.8	-	148	1,139	331	47	-
31	POL	267	48	-	75.0	22.9	2.1	-	-	200	61	6	-
31	ZAP	920	176	16.5	60.8	21.6	1.1	-	152	559	199	10	-
Aug.													
1	NEP(east)	793	143	7.7	62.9	28.0	1.4	-	61	499	222	11	-
1	NEP(west)	760	143	9.1	64.3	25.2	1.4	-	69	489	191	11	-
2	REEF	1,789	326	21.8	61.1	15.6	1.5	-	390	1,093	279	27	-
Season total		[2]35,292	6,769						1,673	18,706	13,279	1,542	92

1/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

2/ The total kill of males was 36,349; age was not determined for 1,057 young males killed 3-16 August.

Table A- 2. --Cumulative age classification of male seals killed on St. Paul Island, 26 June to 2 August 1968

Date	Rookery[1]	Estimated seals killed from each age group					Total kill	Seals killed from each age group				
		2	3	4	5	6		2	3	4	5	6
		Number						Percent				
June												
26	TZR	5	273	643	70	5	996	0.5	27.4	64.6	7.0	0.5
27	NEP(east)	10	399	1,003	144	15	1,571	0.6	25.4	63.8	9.2	1.0
27	NEP(west)	16	438	1,125	228	15	1,822	0.9	24.0	61.8	12.5	0.8
27	POL	16	512	1,406	257	20	2,211	0.7	23.2	63.6	11.6	0.9
28	REEF	16	708	2,081	401	26	3,232	0.5	21.9	64.4	12.4	0.8
28	L-K	16	734	2,185	421	26	3,382	0.5	21.7	64.6	12.4	0.8
July												
1	ZAP	16	948	2,640	473	37	4,114	0.4	23.0	64.2	11.5	0.9
1	POL	16	1,006	2,722	493	37	4,274	0.4	23.5	63.7	11.5	0.9
2	NEP(east)	21	1,144	2,946	534	37	4,682	0.5	24.4	62.9	11.4	0.8
2	NEP(west)	21	1,256	3,164	563	37	5,041	0.4	24.9	62.8	11.2	0.7
2	L-K	21	1,264	3,194	567	37	5,083	0.4	24.9	62.8	11.2	0.7
3	REEF	21	1,422	3,424	617	41	5,525	0.4	25.7	62.0	11.2	0.7
3	TZR	28	1,644	3,814	661	48	6,195	0.4	26.5	61.6	10.7	0.8
5	ZAP	38	1,739	3,965	681	48	6,471	0.6	26.9	61.3	10.5	0.7
5	POL	38	1,770	4,038	691	48	6,585	0.6	26.9	61.3	10.5	0.7
6	NEP(east)	43	2,034	4,269	710	53	7,109	0.6	28.6	60.1	10.0	0.7
6	NEP(west)	53	2,159	4,415	731	53	7,411	0.7	29.1	59.6	9.9	0.7
8	TZR	90	2,914	4,953	785	53	8,795	1.0	33.2	56.3	8.9	0.6
9	POL	90	2,974	5,164	790	58	9,076	1.0	32.8	56.9	8.7	0.6
9	REEF	90	3,170	5,370	810	58	9,498	1.0	33.4	56.5	8.5	0.6
10	ZAP	105	3,633	5,829	861	58	10,486	1.0	34.6	55.6	8.2	0.6
10	L-K	105	3,682	5,914	866	58	10,625	1.0	34.6	55.7	8.2	0.5
11	NEP(east)	118	3,883	6,076	879	62	11,018	1.1	35.2	55.1	8.0	0.6
11	NEP(west)	118	3,990	6,167	889	62	11,226	1.1	35.5	54.9	7.9	0.6
12	REEF	123	4,169	6,316	914	62	11,584	1.1	36.0	54.5	7.9	0.5
12	TZR	123	4,239	6,375	924	62	11,723	1.0	36.2	54.4	7.9	0.5
13	TZR	132	4,735	6,717	971	62	12,617	1.0	37.5	53.2	7.7	0.5
15	ZAP	188	6,025	7,514	1,051	66	14,844	1.3	40.6	50.6	7.1	0.4
16	NEP(west	188	6,102	7,561	1,057	66	14,974	1.3	40.7	50.5	7.1	0.4
16	POL	201	6,508	7,826	1,082	66	15,683	1.3	41.5	49.9	6.9	0.4
17	NEP(east)	240	6,975	8,073	1,103	66	16,457	1.4	42.4	49.1	6.7	0.4
17	TZR	245	7,227	8,171	1,108	71	16,822	1.4	43.0	48.6	6.6	0.4
18	REEF	292	7,984	8,593	1,131	71	18,071	1.6	44.2	47.5	6.3	0.4
18	L-K	325	8,571	8,826	1,135	71	18,928	1.7	45.3	46.6	6.0	0.4
19	TZR	330	8,796	8,904	1,145	71	19,246	1.7	45.7	46.3	5.9	0.4
19	ZAP	336	9,091	9,171	1,180	71	19,849	1.7	45.8	46.2	5.9	0.4
20	TZR	347	9,326	9,347	1,201	82	20,303	1.7	45.9	46.1	5.9	0.4
20	POL	347	9,364	9,431	1,210	82	20,434	1.7	45.8	46.2	5.9	0.4
22	NEP(east)	423	10,266	9,824	1,238	82	21,833	1.9	47.0	45.0	5.7	0.4
22	NEP(west)	429	10,518	9,939	1,249	82	22,217	1.9	47.4	44.7	5.6	0.4
23	Reef	533	11,275	10,318	1,264	82	23,472	2.3	48.0	43.9	5.4	0.4
23	L-K	580	11,519	10,432	1,269	82	23,882	2.4	48.2	43.7	5.3	0.4
24	ZAP	620	11,954	10,703	1,279	82	24,638	2.5	48.5	43.5	5.2	0.3
25	TZR	634	12,856	11,155	1,350	86	26,081	2.4	49.3	42.8	5.2	0.3
26	NEP(east)	684	13,076	11,210	1,350	86	26,406	2.6	49.5	42.5	5.1	0.3
26	NEP(west)	728	13,403	11,337	1,370	86	26,924	2.7	49.8	42.1	5.1	0.3
27	POL	744	13,569	11,439	1,375	86	27,213	2.7	49.9	42.0	5.1	0.3
27	L-K	787	13,801	11,568	1,386	86	27,628	2.8	50.0	41.9	5.0	0.3
29	REEF	853	14,727	11,996	1,430	92	29,098	3.0	50.6	41.2	4.9	0.3
30	TZR	1,001	15,866	12,327	1,477	92	30,763	3.2	51.6	40.1	4.8	0.3
31	POL	1,001	16,066	12,388	1,483	92	31,030	3.2	51.8	39.9	4.8	0.3
31	ZAP	1,153	16,625	12,587	1,493	92	31,950	3.6	52.0	39.4	4.7	0.3
Aug.												
1	NEP(east)	1,214	17,124	12,809	1,504	92	32,743	3.7	52.3	39.1	4.6	0.3
1	NEP(west)	1,283	17,613	13,000	1,515	92	33,503	3.8	52.6	38.8	4.5	0.3
2	REEF	1,673	18,706	13,279	1,542	92	35,292[2]	4.7	53.0	37.6	4.4	0.3

1/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

2/ The total kill of males was 36,349; age was not determined for 1,057 young males killed 3-16 August.

Table A-3. -- Age classification of male seals killed on St. George Island, 26 June to 5 August 1968

Date	Rookery[1]	Males killed	Tooth sample	Seals in each age group of sample					Estimated seals killed from each age group				
				2	3	4	5	6	2	3	4	5	6
		Number	Number	----------Percent----------					----------Number----------				
June													
26	ZAP	394	75	-	23.4	68.8	7.8	-	-	92	271	31	-
28	NOR	254	51	-	13.7	74.5	11.8	-	-	35	189	30	-
July													
1	EAST	287	52	-	26.9	71.2	1.9	-	-	77	204	6	-
1	NOR	101	20	-	30.0	60.0	10.0	-	-	30	61	10	-
3	ZAP	475	92	2.2	40.2	55.4	2.2	-	10	192	263	10	-
5	EAST	83	17	-	29.4	58.8	11.8	-	-	24	49	10	-
5	NOR	395	79	2.5	35.5	55.7	6.3	-	10	140	220	25	-
8	ZAP	282	56	3.6	30.3	58.9	5.4	1.8	10	86	166	15	5
8	NOR	113	23	-	60.9	39.1	-	-	-	69	44	-	-
10	EAST	130	26	-	34.6	61.5	3.9	-	-	45	80	5	-
10	NOR	228	46	-	32.6	67.4	-	-	-	74	154	-	-
12	ZAP	250	50	-	36.0	62.0	2.0	-	-	90	155	5	-
15	EAST	349	69	1.4	50.8	40.6	5.8	1.4	5	177	142	20	5
17	NOR	419	83	2.4	57.8	36.2	3.6	-	10	242	152	15	-
17	STAR	152	34	-	50.0	47.0	3.0	-	-	76	71	5	-
19	ZAP	354	70	4.3	38.6	51.4	5.7	-	15	137	182	20	-
19	NOR	442	90	2.2	63.4	31.1	3.3	-	10	280	137	15	-
22	EAST	287	56	3.6	55.4	33.9	7.1	-	10	159	97	21	-
22	NOR	683	134	6.7	55.2	33.6	4.5	-	46	377	229	31	-
24	ZAP	383	79	11.4	44.3	40.5	2.5	1.3	44	170	155	9	5
24	NOR	134	28	-	64.3	35.7	-	-	-	86	48	-	-
26	NOR	178	36	5.6	69.4	16.7	8.3	-	10	123	30	15	-
26	EAST	99	21	4.8	57.1	28.5	4.8	4.8	5	56	28	5	5
29	ZAP	444	91	5.5	65.9	24.2	4.4	-	24	293	107	20	-
29	NOR	437	89	9.0	62.9	24.7	3.4	-	39	275	108	15	-
29	STAR	269	58	13.8	53.5	20.7	10.3	1.7	37	144	56	28	4
31	NOR	201	41	-	75.6	19.6	2.4	2.4	-	152	39	5	5
31	EAST	273	60	6.7	73.3	18.3	1.7	-	18	200	50	5	-
Aug.													
2	NOR	111	23	4.3	73.9	17.4	4.4	-	5	82	19	5	-
2	STAR	96	27	7.4	55.6	29.6	7.4	-	7	54	28	7	-
2	EAST	391	83	13.3	60.2	25.3	1.2	-	52	235	99	5	-
5	STAR	75	20	30.0	45.0	10.0	10.0	5.0	22	33	8	8	4
5	NOR	98	20	5.0	55.0	30.0	5.0	5.0	5	54	29	5	5
5	ZAP	133	27	29.6	63.0	7.4	-	-	39	84	10	-	-
Season total		9,000[2]	1,826						433	4,443	3,680	406	38

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

2/ The total kill of males was 9,276; age was not determined for 276 young males taken 7-12 August.

Table A-4 . --Cumulative age classification of male seals killed on St. George Island, 26 June to 5 August 1968

Date	Rookery[1/]	Estimated seals killed from each age group					Total kill	Seals killed from each age group				
		2	3	4	5	6		2	3	4	5	6
		Number						Percent				
June												
26	ZAP	-	92	271	31	-	394	-	23.3	68.8	7.9	-
28	NOR	-	127	460	61	-	648	-	19.6	71.0	9.4	-
July												
1	EAST	-	204	664	67	-	935	-	21.8	71.0	7.2	-
1	NOR	-	234	725	77	-	1,036	-	22.6	70.0	7.4	-
3	ZAP	10	426	988	87	-	1,511	0.6	28.2	65.4	5.8	-
5	EAST	10	450	1,037	97	-	1,594	0.6	28.2	65.1	6.1	-
5	NOR	20	590	1,257	122	-	1,989	1.0	29.7	63.2	6.1	-
8	ZAP	30	676	1,423	137	5	2,271	1.3	29.8	62.7	6.0	0.2
8	NOR	30	745	1,467	137	5	2,384	1.3	31.3	61.5	5.7	0.2
10	EAST	30	790	1,547	142	5	2,514	1.2	31.4	61.5	5.7	0.2
10	NOR	30	864	1,701	142	5	2,742	1.1	31.5	62.0	5.2	0.2
12	ZAP	30	954	1,856	147	5	2,992	1.0	31.9	62.0	4.9	0.2
15	EAST	35	1,131	1,998	167	10	3,341	1.0	33.9	59.8	5.0	0.3
17	NOR	45	1,373	2,150	182	10	3,760	1.2	36.5	57.2	4.8	0.3
17	STAR	45	1,449	2,221	187	10	3,912	1.2	37.0	56.8	4.8	0.2
19	ZAP	60	1,586	2,403	207	10	4,266	1.4	37.2	56.3	4.9	0.2
19	NOR	70	1,866	2,540	222	10	4,708	1.5	39.6	54.0	4.7	0.2
22	EAST	80	2,025	2,637	243	10	4,995	1.6	40.5	52.8	4.9	0.2
22	NOR	126	2,402	2,866	274	10	5,678	2.2	42.3	50.5	4.8	0.2
24	ZAP	170	2,572	3,021	283	15	6,061	2.8	42.5	49.8	4.7	0.2
24	NOR	170	2,658	3,069	283	15	6,195	2.8	42.9	49.5	4.6	0.2
26	NOR	180	2,781	3,099	298	15	6,373	2.8	43.7	48.6	4.7	0.2
26	EAST	185	2,837	3,127	303	20	6,472	2.9	43.8	48.3	4.7	0.3
29	ZAP	209	3,130	3,234	323	20	6,916	3.0	45.2	46.8	4.7	0.3
29	NOR	248	3,405	3,342	338	20	7,353	3.4	46.3	45.4	4.6	0.3
29	STAR	285	3,549	3,398	366	24	7,622	3.7	46.6	44.6	4.8	0.3
31	NOR	285	3,701	3,437	371	29	7,823	3.7	47.3	43.9	4.7	0.4
31	EAST	303	3,901	3,487	376	29	8,096	3.7	48.2	43.1	4.6	0.4
Aug.												
2	NOR	308	3,983	3,506	381	29	8,207	3.8	48.5	42.7	4.6	0.4
2	STAR	315	4,037	3,534	388	29	8,303	3.8	48.6	42.5	4.7	0.4
2	EAST	367	4,272	3,633	393	29	8,694	4.2	49.1	41.8	4.5	0.4
5	STAR	389	4,305	3,641	401	33	8,769	4.4	49.1	41.5	4.6	0.4
5	NOR	394	4,359	3,670	406	38	8,867	4.4	49.2	41.4	4.6	0.4
5	ZAP	433	4,443	3,680	406	38	9,000	4.8	49.4	40.9	4.5	0.4

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A-5. -- Number of female seals killed, by age, St. Paul Island, 26 June to 16 August 1968

Date	Rookery[2]	Females killed	Estimated seals killed from each age group[1]																						
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		Number	Number																						
June 26 to July 23	(3)----	81	-	-	2	10	11	15	2	3	6	6	-	3	2	5	8	3	3	-	2	-	-	-	-
July 24	ZAP	9	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
25	TZR	20	-	-	4	4	7	1	-	1	1	-	-	-	-	-	-	-	1	-	1	-	-	-	-
26	NEP(west)	22	-	-	-	1	4	-	-	1	7	1	1	1	-	1	1	4	-	-	-	-	-	-	-
27	POL	31	-	-	-	5	2	6	1	2	2	6	2	2	-	-	1	1	-	1	-	-	-	-	-
27	L-K	6	-	-	-	-	1	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	REEF	64	-	-	8	6	9	3	3	4	1	6	4	-	4	4	4	1	1	-	3	3	-	-	-
30	TZR	181	-	1	16	21	29	9	10	7	4	9	1	4	6	12	4	9	13	15	7	1	1	2	-
31	ZAP	117	-	-	14	8	13	4	8	5	6	2	5	6	9	5	11	6	6	6	2	1	-	-	-
31	POL	10	-	-	5	1	1	1	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-
Aug. 1	NEP(east)	61	-	2	3	4	3	2	2	4	9	5	8	5	3	7	2	-	-	1	1	-	-	-	-
1	NEP(west)	209	-	-	13	25	24	17	6	13	12	10	11	17	10	13	13	8	11	3	2	1	-	-	-
2	REEF	422	-	12	50	46	68	28	19	25	28	16	22	28	12	19	9	16	9	6	3	6	-	-	-
3	TZR	154	-	4	23	20	23	-	8	4	4	4	4	16	4	12	8	4	4	4	4	4	-	-	-
3	L-K	63	-	-	3	12	12	3	3	5	5	5	3	-	7	3	-	2	-	-	-	-	-	-	-
5	ZAP	456	3	9	42	50	53	42	19	28	28	19	34	22	25	17	28	5	14	9	9	-	-	-	-
6	NEP(west)	242	-	14	33	22	30	6	14	25	14	14	19	8	17	3	11	6	-	3	3	-	-	-	-
6	NEP(east)	300	-	27	67	36	31	16	4	16	8	31	16	8	16	4	4	4	4	8	-	-	-	-	-
7	POL	78	-	8	17	16	12	5	6	2	-	5	-	1	1	1	-	2	2	-	-	-	-	-	-
7	NEP(west)	654	-	15	92	102	38	26	32	29	38	29	22	15	32	60	32	19	26	22	9	16	-	-	-
8	POL	658	-	6	121	84	84	51	51	60	24	33	21	18	18	15	30	15	3	18	-	3	3	-	-
9	REEF	400	-	44	153	53	34	16	16	19	9	16	6	13	6	6	6	-	3	-	-	-	-	-	-
9	ZAP	378	-	14	98	64	44	37	7	20	27	24	3	3	3	10	-	14	7	-	3	-	-	-	-
12	NEP(east)	917	-	83	212	152	104	87	42	36	27	15	9	24	15	24	36	18	15	12	6	-	-	-	-
12	NEP(west)	291	-	8	63	44	28	20	12	20	16	4	16	4	4	12	8	12	12	4	-	-	-	-	4
13	TZR	546	-	50	110	96	72	36	19	5	12	9	7	12	12	9	17	24	11	17	9	14	5	-	-
13	REEF	421	-	21	212	47	31	28	10	3	3	18	3	-	3	3	5	8	5	5	8	8	-	-	-
14	ZAP	1,303	6	106	293	198	151	119	63	50	50	56	17	39	46	39	36	6	10	6	4	-	4	-	4
15	L-K	529	9	52	114	65	68	19	15	40	34	22	6	12	22	15	15	12	6	-	3	-	-	-	-
15	POL	192	-	17	37	27	24	14	10	10	20	7	3	14	3	3	-	-	3	-	-	-	-	-	-
15	REEF	596	-	64	151	77	74	45	23	58	26	16	9	9	3	7	7	7	7	3	3	7	-	-	-
16	NEP(west)	425	7	13	67	64	46	43	27	30	13	20	13	10	7	23	13	13	-	13	3	-	-	-	-
16	POL	446	-	33	70	60	47	37	27	30	23	10	16	16	7	7	20	13	10	16	-	4	-	-	-
16	TZR	262	7	17	50	37	27	27	34	10	7	13	7	3	10	-	-	7	3	3	-	-	-	-	-
Season total		10,544	32	620	2,143	1,457	1,211	765	494	567	464	431	288	314	307	339	329	239	189	175	89	68	13	2	8

1/ Number in each age was calculated from the age composition determined from samples of canine teeth.

2/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

3/ The females killed at all rookeries during this period were combined because of the small number taken from each rookery.

Table A-6. --Percentage age classification of female seals in sample, St. Paul Island, 26 June to 16 August 1968

Date	Rookery 1/	Tooth sample	Seals in each age group of sample																					
		Number	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
			Percent																					
June 26 to July 23	(2/)----	50	-	-	2.0	12.0	14.0	18.0	2.0	4.0	8.0	8.0	-	4.0	2.0	6.0	10.0	4.0	4.0	-	2.0	-	-	-	-
July 24	ZAP	3	-	-	-	-	-	-	66.7	-	-	-	-	-	-	-	-	-	-	-	33.3	-	-	-	-
25	TZR	15	-	-	20.0	20.0	26.6	6.7	-	6.7	6.7	-	-	-	-	-	-	-	6.7	-	6.7	-	-	-	-
26	NEP(west)	15	-	-	-	6.7	13.3	-	-	6.7	26.6	6.7	6.7	6.7	-	6.7	6.7	13.3	-	-	-	-	-	-	-
27	POL	25	-	-	-	12.0	8.0	16.0	4.0	8.0	8.0	16.0	8.0	8.0	-	-	4.0	4.0	-	4.0	-	-	-	-	-
27	L-K	6	--	-	-	-	16.7	33.3	16.7	33.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	REEF	45	-	-	11.1	8.9	13.3	4.4	4.4	6.7	2.2	8.9	6.7	-	6.7	6.7	6.7	2.2	2.2	-	4.4	4.4	-	-	-
30	TZR	163	-	0.6	8.6	11.7	15.9	4.9	5.5	3.7	2.5	4.9	0.6	2.5	3.1	6.7	2.5	4.9	7.4	8.0	3.7	0.6	0.6	1.2	-
31	ZAP	99	-	-	12.1	7.1	11.1	3.0	7.1	4.0	5.1	2.0	4.0	5.1	8.1	4.0	9.1	5.1	5.1	5.1	2.0	1.0	-	-	-
31	POL	8	-	-	37.5	12.5	12.5	12.5	-	-	-	-	-	12.5	-	-	-	-	-	-	12.5	-	-	-	-
Aug. 1	NEP(east)	58	-	3.4	5.2	6.9	5.2	3.4	3.4	6.9	13.8	8.6	12.1	8.6	5.2	10.4	3.4	-	-	1.7	1.7	-	-	-	-
1	NEP(west)	186	-	-	6.4	11.3	10.8	8.1	2.7	6.4	5.9	4.8	5.4	8.1	4.8	6.4	6.4	3.8	5.4	1.6	1.1	0.5	-	-	-
2	REEF	136	-	2.9	11.8	11.0	16.2	6.6	4.4	5.9	6.6	3.7	5.2	6.6	2.9	4.4	2.2	3.7	2.2	1.5	0.7	1.5	-	-	-
3	TZR	39	-	2.6	15.4	12.8	15.4	5.1	2.6	-	2.6	2.6	2.6	10.2	2.6	7.7	5.1	2.6	2.6	2.6	2.6	2.6	-	-	-
3	L-K	25	-	-	4.0	20.0	20.0	4.0	4.0	8.0	8.0	8.0	4.0	-	12.0	4.0	-	4.0	-	-	-	-	-	-	-
5	ZAP	163	0.6	1.9	9.2	11.0	11.7	9.2	4.3	6.1	6.1	4.3	7.4	4.9	5.5	3.7	6.1	1.2	3.1	1.9	1.9	-	-	-	-
6	NEP(west)	87	-	5.8	13.8	9.2	12.6	2.3	5.7	10.4	5.8	5.8	8.0	3.5	6.9	1.1	4.6	2.3	-	1.1	1.1	-	-	-	-
6	NEP(east)	76	-	9.2	22.4	11.9	10.5	5.3	1.3	5.3	2.6	10.5	5.3	2.6	5.3	1.3	1.3	1.3	1.3	2.6	-	-	-	-	-
7	POL	69	-	10.2	21.7	20.3	16.0	5.8	7.3	2.0	-	5.8	-	1.4	1.4	1.4	-	2.9	2.9	-	-	-	-	-	-
7	NEP(west)	206	-	2.4	14.1	15.5	5.8	3.9	4.9	4.4	5.8	4.4	3.4	2.4	4.9	9.2	4.9	2.9	3.9	3.4	1.4	2.4	-	-	-
8	POL	219	-	0.9	18.3	12.8	12.8	7.8	7.8	9.1	3.6	5.0	3.2	2.7	2.7	2.3	4.6	2.3	0.5	2.7	-	0.5	0.4	-	-
9	REEF	128	-	10.9	38.3	13.3	8.5	3.9	3.9	4.7	2.3	3.9	1.6	3.1	1.6	1.6	1.6	-	0.8	-	-	-	-	-	-
9	ZAP	112	-	3.6	25.9	17.0	11.6	9.8	1.8	5.3	7.1	6.2	0.9	0.9	0.9	2.7	-	3.6	1.8	-	0.9	-	-	-	-
12	NEP(east)	307	-	9.1	23.1	16.6	11.4	9.5	4.6	3.9	2.9	1.6	1.0	2.6	1.6	2.6	3.9	2.0	1.6	1.3	0.7	-	-	-	-
12	NEP(west)	73	-	2.7	21.9	15.1	9.6	6.8	4.1	6.8	5.5	1.4	5.5	1.4	1.4	4.1	2.7	4.1	4.1	1.4	-	-	-	-	1.4
13	TZR	229	-	9.2	20.1	17.5	13.1	6.6	3.5	0.9	2.2	1.7	1.3	2.2	2.2	1.7	3.0	4.4	2.0	3.0	1.7	2.6	0.9	-	-
13	REEF	161	-	5.0	50.3	11.2	7.5	6.8	2.5	0.6	0.6	4.4	0.6	-	0.6	0.6	1.2	1.9	1.2	1.2	1.9	1.9	-	-	-
14	ZAP	395	0.5	8.1	22.5	15.2	11.6	9.1	4.8	3.8	3.8	4.3	1.3	3.0	3.5	3.0	2.8	0.5	0.8	0.5	0.3	-	0.3	-	0.3
15	L-K	172	1.7	9.9	21.5	12.2	12.8	3.5	2.9	7.5	6.4	4.1	1.2	2.3	4.1	2.9	2.9	2.3	1.2	-	0.6	-	-	-	-
15	POL	57	-	8.8	19.3	14.0	12.3	7.0	5.2	5.2	10.5	3.5	1.8	7.0	1.8	1.8	-	-	1.8	-	-	-	-	-	-
15	REEF	185	-	10.8	25.4	13.0	12.4	7.6	3.8	9.7	4.3	2.7	1.6	1.6	0.5	1.1	1.1	1.1	1.1	0.5	0.5	1.1	-	-	-
16	NEP(west)	128	1.6	3.1	15.6	14.9	10.9	10.2	6.3	7.0	3.1	4.7	3.1	2.3	1.6	5.5	3.1	3.1	-	3.1	0.8	-	-	-	-
16	POL	134	-	7.5	15.7	13.4	10.5	8.2	6.0	6.7	5.2	2.2	3.7	3.7	1.5	1.5	4.5	3.0	2.2	3.7	-	0.8	-	-	-
16	TZR	78	2.6	6.4	19.2	14.1	10.3	10.3	12.8	3.8	2.6	5.1	2.6	1.3	3.8	-	-	2.6	1.3	1.3	-	-	-	-	-
Season total		3,852																							

1/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

2/ The tooth samples from all rookeries were combined during this period because of the small number of female seals taken from each rookery.

Table A-7.--Cumulative numbers of female seals killed, by age, St. Paul Island, 26 June to 16 August 1968

Date	Rookery[1/]	Total kill	Estimated seals killed from each age group																					
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
			Number																					
June 26 to July 23	(2/)----	81	-	-	2	10	11	15	2	3	6	6	-	3	2	5	8	3	3	-	2	-	-	-	-
July 24	ZAP	90	-	-	2	10	17	15	2	3	6	6	-	3	2	5	8	3	3	-	5	-	-	-	-
25	TZR	110	-	-	6	14	24	16	2	4	7	6	-	3	2	5	8	3	4	-	6	-	-	-	-
26	NEP(west)	132	-	-	6	15	28	16	2	5	14	7	1	4	2	6	9	7	4	-	6	-	-	-	-
27	POL	163	-	-	6	20	30	22	3	7	16	13	3	6	2	6	10	8	4	1	6	-	-	-	-
27	L-K	169	-	-	6	20	31	24	4	9	16	13	3	6	2	6	10	8	4	1	6	-	-	-	-
29	REEF	233	-	-	14	26	40	27	7	13	17	19	7	6	6	10	14	9	5	1	9	3	-	-	-
30	TZR	414	-	1	30	47	69	36	17	20	21	28	8	10	12	22	18	18	18	16	16	4	1	2	-
31	ZAP	531	-	1	44	55	82	40	25	25	27	30	13	16	21	27	29	24	24	22	18	5	1	2	-
31	POL	541	-	1	49	56	83	41	25	25	27	30	13	17	21	27	29	24	24	22	19	5	1	2	-
Aug. 1	NEP(east)	602	-	3	52	60	86	43	27	29	36	35	21	22	24	34	31	24	24	23	20	5	1	2	-
1	NEP(west)	811	-	3	65	85	110	60	33	42	48	45	32	39	34	47	44	32	35	26	22	6	1	2	-
2	REEF	1,233	-	15	115	131	178	88	52	67	76	61	54	67	46	66	53	48	44	32	25	12	1	2	-
3	TZR	1,387	-	19	138	151	201	88	60	71	80	65	58	83	50	78	61	52	48	36	29	16	1	2	-
3	L-K	1,450	-	19	141	163	213	91	63	76	85	70	61	83	57	81	61	54	48	36	29	16	1	2	-
5	ZAP	1,906	3	28	183	213	266	133	82	104	113	89	95	105	82	98	89	59	62	45	38	16	1	2	-
6	NEP(west)	2,148	3	42	216	235	296	139	96	129	127	103	114	113	99	101	100	65	62	48	41	16	1	2	-
6	NEP(east)	2,448	3	69	283	271	327	155	100	145	135	134	130	121	115	105	104	69	66	56	41	16	1	2	-
7	POL	2,526	3	77	300	287	339	160	106	147	135	139	130	122	116	106	104	71	68	56	41	16	1	2	-
7	NEP(west)	3,180	3	92	392	389	377	186	138	176	173	168	152	137	148	166	136	90	94	78	50	32	1	2	-
8	POL	3,838	3	98	513	473	461	237	189	236	197	201	173	155	166	181	166	105	97	96	50	35	4	2	-
9	REEF	4,238	3	142	666	526	495	253	205	255	206	217	179	168	172	187	172	105	100	96	50	35	4	2	-
9	ZAP	4,616	3	156	764	590	539	290	212	275	233	241	182	171	175	197	172	119	107	96	53	35	4	2	-
12	NEP(east)	5,533	3	239	976	742	643	377	254	311	260	256	191	195	190	221	208	137	122	108	59	35	4	2	-
12	NEP(west)	5,824	3	247	1,039	786	671	397	266	331	276	260	207	199	194	233	216	149	134	112	59	35	4	2	4
13	TZR	6,370	3	297	1,149	882	743	433	285	336	288	269	214	211	206	242	233	173	145	129	68	49	9	2	4
13	REEF	6,791	3	318	1,361	929	774	461	295	339	291	287	217	211	209	245	238	181	150	134	76	57	9	2	4
14	ZAP	8,094	9	424	1,654	1,127	925	580	358	389	341	343	234	250	255	284	274	187	160	140	80	57	13	2	8
15	L-K	8,623	18	476	1,768	1,192	993	599	373	429	375	365	240	262	277	299	289	199	166	140	83	57	13	2	8
15	POL	8,815	18	493	1,805	1,219	1,017	613	383	439	395	372	243	276	280	302	289	199	169	140	83	57	13	2	8
15	REEF	9,411	18	557	1,956	1,296	1,091	658	406	497	421	388	252	285	283	309	296	206	176	143	86	64	13	2	8
16	NEP(west)	9,836	25	570	2,023	1,360	1,137	701	433	527	434	408	265	295	290	332	309	219	176	156	89	64	13	2	8
16	POL	10,282	25	603	2,093	1,420	1,184	738	460	557	457	418	281	311	297	339	329	232	186	172	89	68	13	2	8
16	TZR	10,544	32	620	2,143	1,457	1,211	765	494	567	464	431	288	314	307	339	329	239	189	175	89	68	13	2	8

1/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

2/ The females killed at all rookeries during this period were combined because of the small number taken from each rookery.

Table A-8 . --Cumulative percentages of female seals killed, by age, St. Paul Island, 26 June to 16 August 1968

Date	Rookery 1/	Total kill	Seals killed from each age group																					
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		Number	Percent																					
June 26 to July 23	(2/)----	81	-	-	2.0	12.0	14.0	18.0	2.0	4.0	8.0	8.0	-	4.0	2.0	6.0	10.0	4.0	4.0	-	2.0	-	-	-	-
July 24	ZAP	90	-	-	2.2	11.1	18.9	16.7	2.2	3.3	6.7	6.7	-	3.3	2.2	5.6	8.9	3.3	3.3	-	5.6	-	-	-	-
25	TZR	110	-	-	5.5	12.7	21.8	14.6	1.8	3.6	6.4	5.5	-	2.7	1.8	4.5	7.3	2.7	3.6	-	5.5	-	-	-	-
26	NEP(west)	132	-	-	4.6	11.4	21.2	12.1	1.5	3.8	10.6	5.3	0.7	3.0	1.5	4.6	6.8	5.3	3.0	-	4.6	-	-	-	-
27	POL	163	-	-	3.7	12.3	18.4	13.5	1.8	4.3	9.8	8.0	1.8	3.7	1.2	3.7	6.1	4.9	2.5	0.6	3.7	-	-	-	-
27	L-K	169	-	-	3.6	11.8	18.3	14.2	2.3	5.3	9.5	7.7	1.8	3.6	1.2	3.6	5.9	4.7	2.3	0.6	3.6	-	-	-	-
29	REEF	233	-	-	6.0	11.1	17.2	11.6	3.0	5.6	7.3	8.1	3.0	2.6	2.6	4.3	6.0	3.9	2.1	0.4	3.9	1.3	-	-	-
30	TZR	414	-	0.2	7.3	11.4	16.7	8.7	4.1	4.8	5.1	6.8	1.9	2.4	2.9	5.3	4.3	4.3	4.3	3.9	3.9	1.0	0.2	0.5	-
31	ZAP	531	-	0.2	8.3	10.4	15.4	7.5	4.7	4.7	5.1	5.7	2.4	3.0	4.0	5.1	5.5	4.5	4.5	4.1	3.4	0.9	0.2	0.4	-
31	POL	541	-	0.2	9.1	10.4	15.3	7.6	4.6	4.6	5.0	5.5	2.4	3.1	3.9	5.4	5.0	4.4	4.4	4.1	3.5	0.9	0.2	0.4	-
Aug. 1	NEP(east)	602	-	0.5	8.6	10.0	14.3	7.1	4.5	4.8	6.0	5.8	3.5	3.7	4.0	5.7	5.1	4.0	4.0	3.8	3.3	0.8	0.2	0.3	-
1	NEP(west)	811	-	0.4	8.0	10.5	13.6	7.4	4.1	5.2	5.9	5.6	4.0	4.8	4.2	5.8	5.4	3.9	4.3	3.2	2.7	0.7	0.1	0.2	-
2	REEF	1,233	-	1.2	9.3	10.6	14.4	7.1	4.2	5.4	6.2	5.0	4.4	5.4	3.7	5.4	4.3	3.9	3.6	2.6	2.0	1.0	0.1	0.2	-
3	TZR	1,387	-	1.4	9.9	10.9	14.5	6.3	4.3	5.1	5.8	4.7	4.2	6.0	3.6	5.6	4.4	3.7	3.5	2.6	2.1	1.2	0.1	0.1	-
3	L-K	1,450	-	1.3	9.7	11.3	14.7	6.3	4.3	5.3	5.9	4.8	4.2	5.7	3.9	5.6	4.2	3.7	3.3	2.5	2.0	1.1	0.1	0.1	-
5	ZAP	1,906	0.2	1.5	9.6	11.2	14.0	7.0	4.3	5.4	5.9	4.7	5.0	5.5	4.3	5.1	4.7	3.1	3.2	2.4	2.0	0.8	-	0.1	-
6	NEP(west)	2,148	0.1	2.0	10.1	10.9	13.8	6.5	4.5	6.0	5.9	4.8	5.3	5.3	4.6	4.7	4.7	3.0	2.9	2.2	1.9	0.7	-	0.1	-
6	NEP(east)	2,448	0.1	2.8	11.6	11.1	13.4	6.3	4.1	5.9	5.5	5.5	5.3	4.9	4.7	4.3	4.2	2.8	2.7	2.3	1.7	0.7	-	0.1	-
7	POL	2,526	0.1	3.1	11.9	11.4	13.4	6.3	4.2	5.8	5.4	5.5	5.2	4.8	4.6	4.2	4.1	2.8	2.7	2.2	1.6	0.6	-	0.1	-
7	NEP(west)	3,180	0.1	2.9	12.3	12.2	11.9	5.8	4.3	5.5	5.4	5.3	4.8	4.3	4.7	5.2	4.3	2.8	3.0	2.5	1.6	1.0	-	0.1	-
8	POL	3,838	0.1	2.6	13.4	12.3	12.0	6.2	4.9	6.2	5.1	5.2	4.5	4.0	4.3	4.7	4.3	2.7	2.5	2.5	1.3	0.9	0.1	0.1	-
9	REEF	4,238	0.1	3.4	15.7	12.4	11.7	6.0	4.8	6.0	4.9	5.1	4.2	4.0	4.0	4.4	4.0	2.5	2.4	2.3	1.2	0.8	0.1	-	-
9	ZAP	4,616	0.1	3.4	16.6	12.8	11.7	6.3	4.6	6.0	5.0	5.2	3.9	3.7	3.8	4.3	3.7	2.6	2.3	2.0	1.1	0.8	0.1	-	-
12	NEP(east)	5,533	0.1	4.3	17.6	13.4	11.6	6.8	4.6	5.6	4.7	4.6	3.5	3.5	3.4	4.0	3.8	2.5	2.2	2.0	1.1	0.6	0.1	-	-
12	NEP(west)	5,824	0.1	4.2	17.8	13.5	11.5	6.8	4.6	5.7	4.7	4.5	3.5	3.4	3.3	4.0	3.7	2.6	2.3	1.9	1.0	0.6	0.1	-	0.1
13	TZR	6,370	-	4.7	18.0	13.8	11.7	6.8	4.5	5.3	4.5	4.2	3.4	3.3	3.2	3.8	3.7	2.7	2.3	2.0	1.1	0.8	0.1	-	0.1
13	REEF	6,791	-	4.7	20.0	13.7	11.4	6.8	4.4	5.0	4.3	4.2	3.2	3.1	3.1	3.6	3.5	2.7	2.2	2.0	1.1	0.8	0.1	-	0.1
14	ZAP	8,094	0.1	5.2	20.4	13.9	11.4	7.2	4.4	4.8	4.2	4.2	2.9	3.1	3.2	3.5	3.4	2.3	2.0	1.7	1.0	0.7	0.2	-	0.1
15	L-K	8,623	0.2	5.5	20.5	13.8	11.5	7.0	4.3	5.0	4.3	4.2	2.8	3.0	3.2	3.5	3.4	2.3	1.9	1.6	1.0	0.7	0.2	-	0.1
15	POL	8,815	0.2	5.6	20.5	13.8	11.5	7.0	4.3	5.0	4.5	4.2	2.8	3.1	3.2	3.4	3.3	2.3	1.9	1.6	0.9	0.6	0.2	-	0.1
15	REEF	9,411	0.2	5.9	20.8	13.8	11.6	7.0	4.3	5.3	4.5	4.1	2.7	3.0	3.0	3.3	3.1	2.2	1.9	1.5	0.9	0.7	0.1	-	0.1
16	NEP(west)	9,836	0.3	5.8	20.6	13.8	11.6	7.1	4.4	5.4	4.4	4.1	2.7	3.0	2.9	3.4	3.1	2.2	1.8	1.6	0.9	0.7	0.1	-	0.1
16	POL	10,282	0.2	5.9	20.3	13.8	11.5	7.2	4.5	5.4	4.4	4.1	2.7	3.0	2.9	3.3	3.2	2.3	1.8	1.7	0.9	0.7	0.1	-	0.1
16	TZR	10,544	0.3	5.9	20.3	13.8	11.5	7.3	4.7	5.4	4.4	4.1	2.7	3.0	2.9	3.2	3.1	2.3	1.8	1.7	0.8	0.6	0.1	-	0.1

1/ NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR-Tolstoi, Zapadni Reef, and Little Zapadni; POL-Polovina and Little Polovina; ZAP-Zapadni; REEF Reef, Gorbatch, and Ardiguen; L-K=Lukanin and Kitovi.

2/ The females killed at all rookeries during this period were combined because of the small number taken from each rookery.

Table A-9.--Number of female seals killed, by age, St. George Island, 29 July to 12 August 1968

Date	Rookery[1]	Females killed	Estimated seals killed from each age group[2]																			
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Number	Number																			
July																						
29	NOR	7	-	-	-	1	-	-	1	1	-	1	1	-	-	-	-	-	-	1	1	-
29	STAR	22	-	-	1	5	-	4	-	-	1	1	-	1	1	-	3	3	1	1	-	-
Aug.																						
2	STAR	58	-	-	10	10	-	-	-	7	4	4	-	7	10	-	-	-	-	3	-	3
5	STAR	34	-	-	8	5	4	2	1	1	3	2	3	2	1	1	-	1	-	-	-	-
5	ZAP	14	-	1	-	1	-	-	1	-	-	1	1	-	1	-	-	1	6	1	-	-
7	ZAP	854	3	26	154	114	105	61	55	61	26	35	29	38	29	16	38	26	16	13	9	-
9	EAST	513	-	11	87	63	92	42	42	24	34	16	24	2	21	19	8	11	11	2	2	2
9	NOR	470	-	16	102	69	73	57	20	36	12	25	12	12	16	8	4	8	-	-	-	-
12	STAR	219	-	16	53	43	31	19	12	12	9	3	-	6	6	3	-	3	-	3	-	-
12	NOR	562	-	14	72	68	65	68	34	48	31	17	21	31	48	13	13	13	-	-	3	3
Season total		3/2,753	3	84	487	379	370	253	166	190	120	105	91	99	133	60	66	66	34	24	15	8

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.
2/ Number in each age was calculated from the age composition determined from samples of canine teeth.
3/ The total kill of females was 2,791; age was not determined for an additional 38 females taken 26 June to 5 August.

Table A-10.--Percentage age classification of female seals in sample, St. George Island, 29 July to 12 August 1968

Date	Rookery[1]	Tooth sample	Seals in each age group of sample																			
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Number	Percent																			
July																						
29	NOR	7	-	-	-	14.3	-	-	14.3	14.3	-	14.3	14.3	-	-	-	-	-	-	14.3	14.3	-
29	STAR	18	-	-	5.5	22.2	-	16.7	-	-	5.6	5.6	-	5.6	5.6	-	11.1	11.1	5.5	5.5	-	-
Aug.																						
2	STAR	17	-	-	17.6	17.6	-	-	-	11.8	5.9	5.9	-	11.8	17.6	-	-	-	-	5.9	-	5.9
5	STAR	31	-	-	22.5	12.9	9.7	6.5	3.2	3.2	9.7	6.5	9.7	6.5	3.2	3.2	-	3.2	-	-	-	-
5	ZAP	12	-	8.3	-	8.3	-	-	8.3	-	-	8.3	8.3	-	8.3	-	-	8.3	33.3	8.3	-	-
7	ZAP	267	0.4	3.0	18.0	13.4	12.3	7.1	6.4	7.1	3.0	4.1	3.4	4.5	3.4	1.9	4.5	3.0	1.9	1.5	1.1	-
9	EAST	195	-	2.1	16.9	12.3	17.9	8.2	8.2	4.6	6.7	3.1	4.6	0.5	4.1	3.6	1.5	2.1	2.1	0.5	0.5	0.5
9	NOR	116	-	3.4	21.6	14.7	15.5	12.1	4.3	7.7	2.6	5.2	2.6	2.6	3.4	1.7	0.9	1.7	-	-	-	-
12	STAR	71	-	7.1	24.0	19.7	14.1	8.5	5.6	5.6	4.2	1.4	-	2.8	2.8	1.4	-	1.4	-	1.4	-	-
12	NOR	165	-	2.4	12.7	12.1	11.5	12.1	6.1	8.5	5.5	3.0	3.7	5.5	8.5	2.4	2.4	2.4	-	-	0.6	0.6
Season total		899																				

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A-11. --Cumulative numbers of female seals killed, by age, St. George Island, 29 July to 12 August 1968

Date	Rookery[1]	Total kill	Estimated seals killed from each age group																		
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
			Number																			
July 29	NOR	7	-	-	-	1	-	-	1	1	-	1	1	-	-	-	-	-	-	1	1	-
29	STAR	29	-	-	1	6	-	4	1	1	1	2	1	1	1	-	3	3	1	2	1	-
Aug. 2	STAR	87	-	-	11	16	-	4	1	8	5	6	1	8	11	-	3	3	1	5	1	3
5	STAR	121	-	-	19	21	4	6	2	9	8	8	4	10	12	1	3	4	1	5	1	3
5	ZAP	135	-	1	19	22	4	6	3	9	8	9	5	10	13	1	3	5	7	6	1	3
7	ZAP	989	3	27	173	136	109	67	58	70	34	44	34	48	42	17	41	31	23	19	10	3
9	EAST	1,502	3	38	260	199	201	109	100	94	68	60	58	50	63	36	49	42	34	21	12	5
9	NOR	1,972	3	54	362	268	274	166	120	130	80	85	70	62	79	44	53	50	34	21	12	5
12	STAR	2,191	3	70	415	311	305	185	132	142	89	88	70	68	85	47	53	53	34	24	12	5
12	NOR	2,753	3	84	487	379	370	253	166	190	120	105	91	99	133	60	66	66	34	24	15	8

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A-12. --Cumulative percentages of female seals killed, by age, St. George Island, 29 July to 12 August 1968

Date	Rookery[1]	Total kill	Seals killed from each age group																		
			2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Number	Percent																			
July 29	NOR	7	-	-	-	14.3	-	-	14.3	14.3	-	14.3	14.3	-	-	-	-	-	-	14.3	14.3	-
29	STAR	29	-	-	3.4	20.7	-	13.8	3.4	3.4	3.4	6.9	3.4	3.4	3.4	-	10.4	10.4	3.4	6.9	3.4	-
Aug. 2	STAR	87	-	-	12.6	18.4	-	4.6	1.1	9.2	5.8	6.9	1.1	9.2	12.6	-	3.5	3.5	1.1	5.8	1.1	3.5
5	STAR	121	-	-	15.7	17.4	3.3	5.0	1.7	7.4	6.6	6.6	3.3	8.3	9.9	0.8	2.5	3.3	0.8	4.1	0.8	2.5
5	ZAP	135	-	0.7	14.1	16.3	3.0	4.5	2.2	6.7	5.9	6.7	3.7	7.4	9.6	0.7	2.2	3.7	5.2	4.5	0.7	2.2
7	ZAP	989	0.3	2.7	17.5	13.8	11.0	6.8	5.9	7.1	3.4	4.5	3.4	4.9	4.3	1.7	4.1	3.1	2.3	1.9	1.0	0.3
9	EAST	1,502	0.2	2.5	17.3	13.2	13.4	7.2	6.7	6.3	4.5	4.0	3.9	3.3	4.2	2.4	3.3	2.8	2.3	1.4	0.8	0.3
9	NOR	1,972	0.2	2.7	18.4	13.6	13.9	8.4	6.1	6.6	4.1	4.3	3.5	3.1	4.0	2.2	2.7	2.5	1.7	1.1	0.6	0.3
12	STAR	2,191	0.1	3.2	18.9	14.2	13.9	8.4	6.0	6.5	4.1	4.0	3.2	3.1	3.9	2.2	2.4	2.4	1.6	1.1	0.6	0.2
12	NOR	2,753	0.1	3.1	17.7	13.8	13.4	9.2	6.0	6.9	4.4	3.8	3.3	3.6	4.8	2.2	2.4	2.4	1.2	0.9	0.5	0.3

1/ ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A-13.--Dead seal pups counted, by rookery, Pribilof Islands, Alaska, 1959-68

Rookery	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
	Number									
St. Paul Island										
Morjovi	4,560	6,825	5,259	4,881	2,348	1,830	2,649	1,686	1,072	2,285
Vostochni	7,105	11,333	10,173	8,565	5,057	3,404	4,214	2,785	1,969	4,195
Little Polovina	1,597	2,427	2,415	2,121	923	631	1,132	449	233	509
Polovina Cliffs	2,586	3,462	4,576	2,957	2,160	1,097	2,856	809	825	1,616
Polovina	3,311	5,268	2,499	1,880	1,237	783	1,176	312	319	487
Ardiguen	141	331	411	225	141	102	459	160	90	118
Gorbatch	2,100	3,168	3,550	1,373	2,431	1,549	3,123	1,593	874	1,446
Reef	6,052	9,664	10,047	7,897	5,688	3,000	7,664	3,562	2,008	3,064
Kitovi	882	2,006	2,215	2,081	881	462	2,202	406	522	755
Lukanin	631	1,037	1,294	660	546	402	1,126	432	240	597
Tolstoi	3,691	5,237	4,761	3,004	3,274	2,614	3,955	3,425	2,251	3,315
Little Zapadni	1,691	4,148	3,047	2,399	2,580	1,101	2,461	1,634	1,098	1,781
Zapadni Reef	608	1,472	1,291	598	718	425	723	451	380	685
Zapadni	5,009	6,450	6,329	6,627	4,614	4,172	5,384	3,710	2,195	4,445
Counted total	39,964	62,828	57,867	45,268	32,598	21,572	39,124	21,414	14,076	25,298
Estimated oversight 5%	1,998	2,946	2,893	2,263	1,630	1,079	1,956	1,071	704	1,265
Total	41,962	65,774	60,760	47,531	34,228	22,651	41,080	22,485	14,780	26,563
St. George Island										
North	2,653	3,489	3,883	2,242	2,525	792	1,854	1,561	971	1,567
Zapadni	1,633	1,902	2,019	1,740	704	446	1,263	1,196	578	1,197
East	664	1,112	1,347	504	502	272	676	764	201	824
Staraya Artil	1,987	2,000	2,514	1,435	1,041	767	1,186	1,152	770	1,055
Counted total	6,937	8,503	9,763	5,921	4,772	2,277	4,979	4,673	2,520	4,643
Estimated oversight 5%	347	425	488	296	239	114	249	234	126	232
Total	7,284	8,928	10,251	6,217	5,011	2,391	5,228	4,907	2,646	4,875
Pribilof Islands total[1/]	49,246	74,702	71,011	53,748	39,239	25,042	46,308	27,392	17,426	31,438

1/ Not included in the total are 2,228 dead pups counted on Sea Lion Rock (Sivutch) in 1966.

Table A-14.--Dead seal pups counted, by rookery sections, St. Paul Island, 22-27 August 1968

Rookery	Section[1/]													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13&14	
Morjovi	-	1,274	-	381	256	374	-	-	-	-	-	-	-	2,285
Vostochni	199	138	200	165	390	833	291	461	335	127	221	291	544	4,195
Little Polovina	347	162	-	-	-	-	-	-	-	-	-	-	-	509
Polovina Cliffs	229	270	234	192	301	214	176	-	-	-	-	-	-	1,616
Polovina	300	187	-	-	-	-	-	-	-	-	-	-	-	487
Ardiguen[2/]	-	-	-	-	-	-	-	-	-	-	-	-	-	118
Gorbatch	309	360	273	115	389	-	-	-	-	-	-	-	-	1,446
Reef	236	308	391	338	274	483	389	244	154	173	74	-	-	3,064
Kitovi	[3/]231	11	238	176	99	-	-	-	-	-	-	-	-	755
Lukanin	249	348	-	-	-	-	-	-	-	-	-	-	-	597
Tolstoi	237	233	259	125	421	663	573	804	-	-	-	-	-	3,315
Little Zapadni	118	265	394	503	312	189	-	-	-	-	-	-	-	1,781
Zapadni Reef	488	197	-	-	-	-	-	-	-	-	-	-	-	685
Zapadni	310	626	707	894	587	441	613	267	-	-	-	-	-	4,445
Total														25,298

1/ Where possible, each rookery was divided into sections containing about 100 Class 3 males in mid-July and the sections were numbered consecutively.

2/ No numbered sections

3/ Includes 54 dead pups counted in amphitheater.

Table A-15. --Lesions and circumstances associated with cases of multiple hemorrhage-perinatal complex among seal pups, St. Paul Island, 1964 and 1966-68

Date and study area	Pups examined	Pups affected		No bite wounds or contusions	Subscapsular hemorrhage of liver and other organs	Focal necrosis of the liver	Intraocular hemorrhage	Stillborn	Placenta or fresh cord attached
	Number	Number	Percent						
9 July to 22 Aug. 1964 Reef Rookery									
Old catwalk	109	6	5.5	1	-	-	1	1	3
28 June to 22 Aug. 1966 Reef Rookery									
Old catwalk	164	5	3.0	3	-	-	-	1	2
29 June to 15 Aug. 1967 Reef Rookery									
Old catwalk	80	14)		2	3	1	3	3	10
New catwalk	54	10)	17.2	5	3	2	1	2	8
Northeast Point Rookery	98	16)		8	3	2	4	6	14
Total	232	40 1/		15	9	5	8	11	32
Percent				37.5	22.5	12.5	20.0	27.5	80.0
4 July to 15 Aug. 1968 Reef Rookery									
Old catwalk	132	4)		1	1	1	2	1	3
New catwalk	97	9)	5.0	6	1	1	4	4	5
Northeast Point Rookery	150	6)		3	1	1	2	2	4
Total	379	19		10	3	3	8	7	12
Percent				52.6	16.7	16.7	44.4	38.9	66.7

1/ Includes 33 pups affected as the primary cause and 7 as the secondary cause of death.

Table A-16.--Primary causes of death among 379 seal pups, by 7-day periods, St. Paul Island, 5 July to 15 August 1968.

Cause of death	5-11 July	12-18 July	19-25 July	26 July to 1 Aug.	2-8 Aug.	9-15 Aug.	Total
	Number						
Malnutrition	16	34	33	65	19	14	181
Hookworm disease	2	11	19	22	6	4	64
Trauma	8	10	0	1	0	2	21
Microbial infection	1	8	2	6	0	3	20
Perinatal complex	7	4	7	0	0	1	19
Miscellaneous	3	2	0	1	1	0	7
Undetermined	4	1	3	2	1	1	12
Total	41	70	64	97	27	25	324
Unsuitable for examination	10	4	4	1	1	1	[1] 55
Total	51	74	68	98	28	26	[1] 379
Advanced post mortem degeneration	16	17	26	16	2	1	[1] 112

[1] Includes 34 pups, unsuitable for examination, that died before 5 July.

Table A-17.--Adult male seals counted, by class and rookery,[1] St. George Island, 21-22 June 1968.

Rookery	Date	Class of adult male[2]					Total
		1	2	3	4	5	
		Number					
	June						
Zapadni	21	13	151	83	16	344	607
South	21	42	225	129	34	-	430
East Reef	21	-	77	30	17	186	310
East Cliffs	21	18	135	82	65	97	397
Staraya Artil	21	7	183	56	13	122	381
North	22	69	288	226	48	132	763
Total		149	1,059	606	193	881	2,888

[1] The adult males on St. George Island were not counted by section in June because section boundaries were not established until July.

[2] Class 1 Shoreline - Full-grown males about age 10 and older without females but apparently with established territories at the high tide mark.

Class 2 Territorial without females - Full-grown males about age 10 and older without females but with established territories on the rookery.

Class 3 Territorial with females - Full-grown males about age 10 and older with females and established territories on the rookery.

Class 4 Back fringe - Full-grown and partly grown males about age 7 and older without females and territories that are found along the inland fringe of the rookery.

Class 5 Hauling ground - Full-grown and partly grown males about age 7 and older without females that are found on traditional hauling grounds.

Class 3 males were formerly called harem bulls, and Classes 1, 2, 4, and 5 were collectively called idle bulls.

Table A-18. --Adult male seals counted, by class[1/] and rookery section,[2/] St. George Island, 13 July 1968

Rookery and class of male	Sections						Total
	1	2	3	4	5	6	
	Number						
Zapadni							
1	4	4	4	-	-	-	12
2	14	29	35	-	-	-	78
3	73	112	42	-	-	-	227
4	-	3	5	-	-	-	8
5	323	-	-	-	-	-	323
South							
1	8	11	6	-	-	-	25
2	2	4	4	-	-	-	10
3	103	107	109	-	-	-	319
4	-	-	-	-	-	-	-
5	72	-	19	-	-	-	91
North							
1	6	7	7	10	2	3	35
2	7	14	3	11	10	20	65
3	79	114	111	114	108	110	636
4	-	1	3	4	1	19	28
5	75	-	-	-	1	101	177
East Reef[3/]							
1	4	-	-	-	-	-	4
2	12	-	-	-	-	-	12
3	116	-	-	-	-	-	116
4	2	-	-	-	-	-	2
5	12	-	-	-	-	-	12
East Cliffs							
1	8	8	-	-	-	-	16
2	23	8	-	-	-	-	31
3	120	117	-	-	-	-	237
4	2	-	-	-	-	-	2
5	144	7	-	-	-	-	151
Staraya Artil							
1	9	-	-	-	-	-	9
2	20	33	-	-	-	-	53
3	112	101	-	-	-	-	213
4	-	19	-	-	-	-	19
5	90	30	-	-	-	-	120

1/ For description of classes, see table A-17 or glossary.

2/ In 1968, each rookery was divided into sections containing about 100 class 3 males in mid-July and the sections numbered consecutively throughout the rookery.

3/ No numbered sections.

Table A-19.--Adult male seals counted by class[1/] and rookery section,[2/] St. Paul Island, 21-26 June 1968

Rookery and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Number														
Lukanin															
1	4	4	-	-	-	-	-	-	-	-	-	-	-	-	8
2	29	33	-	-	-	-	-	-	-	-	-	-	-	-	62
3	17	28	-	-	-	-	-	-	-	-	-	-	-	-	45
4	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5	15	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Kitovi[3/]															
1	3(1)	12	6	4	5	-	-	-	-	-	-	-	-	-	31
2	26(22)	14	35	40	42	-	-	-	-	-	-	-	-	-	179
3	26(15)	12	22	29	18	-	-	-	-	-	-	-	-	-	122
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	49	-	-	-	-	-	-	-	-	-	49
Reef															
1	2	14	7	1	3	3	-	12	7	6	2	-	-	-	57
2	60	76	63	38	51	35	114	63	50	44	22	-	-	-	616
3	29	32	23	12	16	52	7	27	19	21	17	-	-	-	255
4	6	5	9	10	-	-	-	8	-	-	4	-	-	-	42
5	-	-	-	-	350	-	-	-	-	-	50	-	-	-	400
Gorbatch															
1	7	10	1	-	10	4	-	-	-	-	-	-	-	-	32
2	66	48	46	45	61	75	-	-	-	-	-	-	-	-	341
3	30	26	28	6	17	21	-	-	-	-	-	-	-	-	128
4	5	2	4	3	5	6	-	-	-	-	-	-	-	-	25
5	209	-	-	33	-	-	-	-	-	-	-	-	-	-	242
Ardiguen[4/]															
1															2
2															62
3															42
4															-
5															50
Morjovi[5/]															
1	4(1)	7	4	9	4	6	-	-	-	-	-	-	-	-	35
2	50(20)	22	38	65	55	59	-	-	-	-	-	-	-	-	309
3	33(10)	36	23	47	38	41	-	-	-	-	-	-	-	-	228
4	4(0)	1	4	8	-	4	-	-	-	-	-	-	-	-	21
5	146(0)	-	-	-	-	-	-	-	-	-	-	-	-	-	146
Vostochni															
1	2	1	3	1	-	5	2	5	9	6	9	5	16	3	67
2	66	51	43	36	35	101	53	65	70	48	57	73	70	36	804
3	28	21	19	24	23	43	30	50	42	24	31	49	52	26	462
4	1	-	-	2	1	-	-	5	-	-	-	-	-	2	11
5	72	-	-	59	-	-	102	-	-	-	-	92	13	51	389
Little Polovina															
1	2	10	-	-	-	-	-	-	-	-	-	-	-	-	12
2	42	65	-	-	-	-	-	-	-	-	-	-	-	-	107
3	37	34	-	-	-	-	-	-	-	-	-	-	-	-	71
4	7	7	-	-	-	-	-	-	-	-	-	-	-	-	14
5	4	71	-	-	-	-	-	-	-	-	-	-	-	-	75

See footnotes at end of table.

Table A-19.--Adult male seals counted by class[1/] and rookery section,[2/] St. Paul Island, 21-26 June 1968--Continued

Rookery and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Number														
Polovina															
1	5	3	-	-	-	-	-	-	-	-	-	-	-	-	8
2	53	36	-	-	-	-	-	-	-	-	-	-	-	-	89
3	45	23	-	-	-	-	-	-	-	-	-	-	-	-	68
4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
5	163	14	-	-	-	-	-	-	-	-	-	-	-	-	177
Polovina Cliffs															
1	1	4	7	12	8	6	14	-	-	-	-	-	-	-	52
2	49	42	33	31	43	44	73	-	-	-	-	-	-	-	315
3	26	25	34	33	49	37	52	-	-	-	-	-	-	-	256
4	2	5	3	4	-	-	16	-	-	-	-	-	-	-	16
5	-	-	-	-	-	74	-	-	-	-	-	-	-	-	74
Tolstoi															
1	5	7	7	7	10	5	4	4	-	-	-	-	-	-	49
2	22	32	36	20	63	57	46	74	-	-	-	-	-	-	350
3	39	30	35	19	61	60	37	28	-	-	-	-	-	-	309
4	-	1	-	-	-	5	-	19	-	-	-	-	-	-	25
5	-	-	-	-	-	-	-	150	-	-	-	-	-	-	150
Zapadni Reef															
1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
2	56	16	-	-	-	-	-	-	-	-	-	-	-	-	72
3	42	33	-	-	-	-	-	-	-	-	-	-	-	-	75
4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
5	7	52	-	-	-	-	-	-	-	-	-	-	-	-	59
Little Zapadni															
1	-	1	6	8	11	1	-	-	-	-	-	-	-	-	27
2	23	23	47	54	28	43	-	-	-	-	-	-	-	-	218
3	20	35	44	62	34	39	-	-	-	-	-	-	-	-	234
4	2	-	-	3	4	-	-	-	-	-	-	-	-	-	9
5	24	-	-	-	-	60	-	-	-	-	-	-	-	-	84
Zapadni[6/]															
1	3(0)	6	9	11	6	11	8	1	-	-	-	-	-	-	55
2	56(0)	83	74	90	69	53	64	19	-	-	-	-	-	-	508
3	38(0)	62	41	58	38	58	40	22	-	-	-	-	-	-	357
4	-(0)	17	-	2	2	5	7	1	-	-	-	-	-	-	34
5	-(126)	-	-	-	-	-	-	174	-	-	-	-	-	-	300
Sea Lion Rock[4/]															
1															73
2															288
3															166
4															-
5															150

1/ For description of classes, see table A-17 or glossary.

2/ In 1966, each rookery was divided into sections containing about 100 Class 3 males in mid-July and the sections numbered consecutively throughout the rookery.

3/ Numbers in parentheses are the adult males counted in Kitovi Amphitheater.

4/ No numbered sections.

5/ Numbers in parentheses are the adult males counted on the second point south of Sea Lion Neck.

6/ Numbers in parentheses are the adult males counted on Zapadni Point Reef.

Table A-20. --Adult male seals counted, by class[1/] and rookery section,[2/] St. Paul Island, 10-11 July 1968

Rookery and class of male	Sections														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Number														
Reef															
1	7	12	12	-	6	6	-	6	3	3	-	-	-	-	55
2	6	14	9	12	14	9	36	6	6	5	6	-	-	-	123
3	84	92	79	52	59	82	82	111	72	76	54	-	-	-	843
4	5	8	-	24	4	-	2	-	2	9	3	-	-	-	57
5	-	-	-	-	227	-	-	-	-	-	52	-	-	-	279
Zapadni Reef															
1	5	4	-	-	-	-	-	-	-	-	-	-	-	-	9
2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	5
3	98	46	-	-	-	-	-	-	-	-	-	-	-	-	144
4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	4
5	11	39	-	-	-	-	-	-	-	-	-	-	-	-	50
Vostochni															
1	2	2	2	2	2	4	3	5	10	3	1	5	8	3	52
2	12	-	6	13	7	27	41	24	28	16	17	18	15	5	229
3	84	64	59	52	53	124	71	91	98	53	87	111	113	56	1,116
4	2	2	-	1	1	-	-	1	1	-	-	-	1	-	9
5	44	-	-	28	-	-	20	-	-	-	-	86	-	29	207
Morjovi[3/]															
1	5 (-)	5	-	6	3	6	-	-	-	-	-	-	-	-	25
2	10 (2)	2	11	6	7	28	-	-	-	-	-	-	-	-	66
3	68 (40)	70	59	94	86	88	-	-	-	-	-	-	-	-	505
4	1 (-)	4	2	6	2	-	-	-	-	-	-	-	-	-	15
5	85 (-)	-	-	-	-	-	-	-	-	-	-	-	-	-	85

1/ For description of classes, see table A-17 or glossary.

2/ In 1966, each rookery was divided into sections containing about 100 class 3 males in mid-July and the sections numbered consecutively throughout the rookery.

3/ Numbers in parentheses are the adult males counted on the second point south of Sea Lion Neck.

Table A-21.--Adult male seals counted on Reef, Zapadni Reef, Morjovi, and Vostochni Rookeries, St. Paul Island, 9-14 July 1966 and 1968

Rookery	Class of adult male[1]	1966	1968
		Number	Number
Reef	3	1,070	843
Reef	1, 2, 4, 5	678	514
Total		1,748	1,357
Zapadni Reef	3	203	144
Zapadni Reef	1, 2, 4, 5	210	68
Total		413	212
Morjovi	3	645	505
Morjovi	1, 2, 4, 5	534	191
Total		1,179	696
Vostochni	3	1,449	1,116
Vostochni	1, 2, 4, 5	970	497
Total		2,419	1,613

[1] For description of classes, see table A-17 or glossary.

Table A-22.--Harem and idle male seals counted in mid-July, Pribilof Islands, Alaska, 1959-68.

Year	St. Paul Island		St. George Island		Both islands	
	Harem	Idle	Harem	Idle	Harem	Idle
	----------Number----------		----------Number----------		----------Number----------	
1959	10,003	11,485	2,527	2,699	12,530	14,184
1960	10,247	10,407	2,552	2,630	12,799	13,037
1961	11,163	11,791	2,843	2,489	14,006	14,280
1962	10,332	9,109	2,342	2,650	12,674	11,759
1963	9,212	7,650	2,071	1,890	11,283	9,540
1964	9,085	7,095	1,989	1,489	11,074	8,584
1965	8,553	5,616	1,917	1,113	10,470	6,729
1966	7,974	5,839	1,974	1,017	9,948	6,856
1967[1]	7,230	4,439	1,646	1,268	8,876	5,707
1968[1]	6,176	3,100	1,748	1,283	7,924	4,383

[1] Counts of harem and idle male seals on St. Paul Island were extrapolated from actual counts on Reef, Lukanin, Kitovi, Tolstoi, and Zapadni Reef Rookeries in 1967 and on Reef, Zapadni Reef, Vostochni, and Morjovi Rookeries in 1968.

Table A-23.--Mean weights of untagged and unmarked seal pups about 1 September, St. Paul Island, 1957-68

[Numbers in parentheses are sample sizes]

Sex	Year												Mean
	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1957-68
	Kg.												
Males	8.7 (391)	11.4 (127)	9.4 (444)	9.8 (372)	8.5 (381)	9.2 (300)	8.9 (300)	9.1 (300)	9.5 (300)	9.6 (300)	10.2 (400)	9.6 (400)	9.5
Females	7.7 (351)	9.9 (121)	8.1 (386)	9.1 (363)	8.0 (466)	8.2 (300)	8.0 (300)	7.7 (300)	8.2 (300)	8.4 (300)	9.0 (400)	8.3 (400)	8.4

Table A-24.--Seal pups tagged and marked, Pribilof Islands, Alaska, 1959-68

Year	Series	St. Paul Island	St. George Island	Location of tag	Checkmarks or marks
		Number			
1959	L 1-10000		9,980	Left front flipper	Tip of left front flipper sliced off
	L 10001-50000	39,901		------do. ------	Do.
1960	M 1-12000		11,992	Right front flipper	Tip of right front flipper sliced off
	M 12001-60000	47,989		------do. -------	Do.
1961	N 1-10000		9,988	Left front flipper	"V" notch near tip left front flipper
	N 10001-50000	39,933		------do. ------	Do.
1962	O 1-10000		9,980	Right front flipper	"V" notch near tip right front flipper
	O 10001-50000	39,928		------do. -------	Do.
1963	P 1-5000		4,993	Left front flipper	Tip of left front flipper sliced off
	P 5001-25000	19,978		------do. ------	Do.
1964	Q 1-5000		4,993	Right front flipper	Tip of right front flipper sliced off
	Q 5001-25000	19,998		------do. -------	Do.
1965	R 1-10000	10,000		Left front flipper	"V" notch near tip left front flipper
	Marked	10,007		Not tagged	"V" notch near tip right front flipper
	Marked	10,080		---do. ---	Tip of 1st digit (big toe) on right hind flipper sliced off
1966	S 1-2500		2,499	Left front flipper	Tip of left front flipper sliced off
	S 2501-12500	10,000		Right front flipper	Tip of 2d digit on right hind flipper sliced off
	Marked	9,578		Not tagged	Tip of 3d digit on right hind flipper sliced off
	Marked		2,503	---do. ---	Tip of 2d digit on left hind flipper sliced off
1967	T 9-2500		2,492	Right front flipper	Tip of right front flipper sliced off
	T 5001-15000	9,980		------do. -------	Do.
1968	U 1-2500		2,475	Left front flipper	"V" notch near tip left front flipper
	U 2501-12500	9,200		------do. ------	Do.

Table A-25.--Record of tags applied[1] to male seals selected as yearlings and as 2-, 3-, and 4-year-olds on the basis of body length or size, St. Paul Island, 1961-63 and 1965-68

Age category and year	Tag series	Tag numbers	Effective tags[2]
Yearlings[3]			Number
1961.....	M	1-2000	754
1962.....	N	50001-51000	929
1963.....	O	50001-51000	799
1965.....	1R	1-1000	991
1966.....	1S	20001-21500	1,495
1967.....	1T	1-1500	835
1968.....	1U	20001-21500	714
Ages 2-4			
1966.....	2S	20001-31500	1,483
1967.....	2T	1-1500	1,220
1968.....	2U	30001-31500	1,495

[1] Each seal was double tagged; one tag was attached to each front flipper at the hairline. Some seals with tags that had been attached when they were pups were given another tag.
[2] Total number of seals tagged within the series.
[3] Seals of both sexes were intentionally tagged in 1961-63, and 1965. Only males were intentionally tagged in 1966-68.

Table A-26.--Seal pups tagged and checkmarked, St. Paul Island, 5-17 September 1968

Rookery	Tag numbers (U-series)	Pups marked[1]
		Number
Zapadni.....	2501-3600	1,100
Zapadni Reef....	3601-3900	300
Little Zapadni..	3901-4550	650
Reef.....	4551-6650	2,100
Gorbatch.....	6651-6800	150
Polovina.....	6801-7100	300
Polovina Cliffs.	7101-7800	700
Little Polovina.	7801-8200	400
Vostochni.....	9001-10700	1,700
Tolstoi.....	10701-11700	1,000
Lukanin.....	11701-11950	250
Kitovi.....	11951-12500	550
Total		9,200

[1] Tags were attached to the rear edge of the left front flipper at the hairline; as a checkmark, a V-notch was cut into the leading edge of the same flipper near the tip. No pups were tagged and checkmarked on Morjovi Rookery.

Table A-27.--Seal pups tagged and checkmarked, St. George Island, 26-27 August 1968

Rookery	Tag numbers (U-series)	Pups marked[1]
		Number
Zapadni-South.....	1-700	[2] 675
Staraya Artil.....	701-1000	300
East Reef-East Cliffs.....	1001-1500	500
North.....	1501-2500	1,000
Total.....		2,475

[1] Tags were attached to the rear edge of the left front flipper at the hairline; as a checkmark, a V-notch was cut into the leading edge of the same flipper near the tip. No tags were discarded in 1968 as unfit for application.
[2] A total of 675 tags within the series 1-700 were used.

Table A-28.--Record of 714 yearling male seals tagged, St. Paul Island, September and October 1968

Area	Tag numbers (2U-series)	Effective tags[1]
		Number
English Bay and Zapadni..	20001-20500 20901-20962	549
Northeast Point.....	20501-20597	96
Polovina.....	20801-20839	39
Reef.....	20601-20630	30
Total.....		714

[1] Number of tags used within the series; in addition to the number of effective tags listed, two tags were attached to 2-year-olds, one (1U-20051) to a seal with Soviet tag Y2875 and one (1U-20176) to an untagged seal.

Table A-29.--Record of 28 male seals marked as pups in 1967 and given an additional tag as yearlings, St. Paul Island, September and October 1968

Seals with U.S.A. pup tags		Seals with U.S.A. pup tag lost	Seals with U.S.S.R. pup tags		Seals with a mark[1]
Yearling tag (1U-series)	Pup tag (T-series)	Yearling tag (1U-series)	Yearling tag (1U-series)	U.S.S.R. tag (X-series)	Yearling tag (1U-series)
20020	9161	20413	20096	37098	20565
20066	8461	20443	20119	19325	
20240	13706		20121	12175	
20254	1415		20127	32272	
20304	2038		20189	35058	
20315	12126		20213	37151	
20470	6165		20221	19924	
20471	6577		20313	32569	
20527	12143		20379	33398	
20583	12856		20484	31974	
20607	8911		20503	23492	
			20547	20390	
			20936	20887	
			20957	19825	

[1] Marked by freeze branding on St. Paul Island in 1967--a "T" on the forearm of the right front flipper parallel to the spinal column, and a "T" on the forearm of the left front flipper perpendicular to the spinal column.

Table A-30.--Record of 1,495 male seals tagged at age≥2 years, St. Paul Island, September and October 1968

Area	Tag number (2U-series)	Effective tags
		Number
English Bay and Zapadni	30001-30500 31001-31500	998
Northeast Point	30501-30638	137
Polovina	30639-31000	360
Total		1,495

Table A-31. --Record of 86 male seals marked as pups in 1966 and given additional tags, St. Paul Island, September and October 1968

Seals with U. S. A. pup tag		Seals with U. S. A. pup tag lost (S-series)		Seals with U. S. S. R. pup tags		Seals with a mark	
≥2 tag (2U-series)	Pup tag (S-series)	≥2 tag (2U-series) and mark (RH2)[1/]	≥2 tag (2U-series) and mark (LFS)[2/]	≥2 tag (2U-series)	U. S. S. R. tag (Y-series)	≥2 tag (2U-series) and mark (RH3)[3/]	≥2 tag (2U-series) and mark (LH2)[4/]
30071	10642	30046	30025	30690	21599	30056	30194
30078	7847	30210		30895	21753	30059	30930
30082	6930	30503		31396	31939	30069	
30145	3971	30512				30075	
30170	6662	30626				30153	
30208	10517	30640				30317	
30223	1872	30887				30395	
30246	6903	30923				30428	
30295	9769	30927				30447	
30432	10222	30940				30483	
30448	2537	30960				30531	
30449	9145	31115				30553	
30548	8811	31330				30556	
30616	10387	31342				30575	
30651	4904					30589	
30716	11053					30634	
30727	7437					30641	
30745	7298					30654	
30755	4004					30720	
30767	8981					30735	
30781	5449					30805	
30784	12198					30874	
30822	453					30965	
30833	2619					30973	
30975	7536					31000	
31050	3438					31084	
31105	3802					31129	
31111	4594					31137	
31363	6924					31147	
						31154	
						31166	
						31202	
						31370	
						31421	
						31431	
						31443	
						31475	

1/ RH2 = tip of second digit, right hind flipper, removed.
2/ LFS = tip of left front flipper sliced off.
3/ RH3 = tip of third digit, right hind flipper, removed.
4/ LH2 = tip of second digit, left hind flipper, removed.

Table A-32. --Marked, tagged, and lost-tag seals recovered, by age and sex, Pribilof Islands, Alaska, 26 June to 16 August 1968

Date, sex, and mark or tag series	Age	Marks or tags			Lost-tags[1]			Grand total
		St. Paul Island	St. George Island	Total	St. Paul Island	St. George Island	Total	
	Years	Number			Number			Number
26 June through 2 August								
Males								
S	2	35	6	41	22	10	32	73
Hind flipper (RH3)[2]	2	38	7	45	-	-	-	45
Front flipper (RFV)[2]	3	618	55	673	-	-	-	673
Hind flipper (RH1)[2]	3	633	76	709	-	-	-	709
R	3	358	24	382	177	29	206	588
Q	4	580	162	742	272	36	308	1,050
P	5	53	27	80	24	8	32	112
O	6	4	-	4	8	10	18	22
N	7	3	-	3	-	-	-	3
Females[3]								
Front flipper (RFV)[2]	3	1	-	1	-	-	-	1
Hind flipper (RH1)[2]	3	1	-	1	-	-	-	1
Q	4	4	-	4	2	-	2	6
P	5	2	-	2	4	-	4	6
O	6	8	-	8	1	-	1	9
N	7	7	-	7	-	-	-	7
M	8	1	-	1	-	-	-	1
L	9	3	-	3	-	-	-	3
K	10	3	-	3	-	-	-	3
I	12	2	-	2	-	-	-	2
E	16	2	-	2	-	-	-	2
3 August through 16 August								
Males								
S	2	1	4	5	2	-	2	7
Hind flipper (RH3)[2]	2	5	-	5	-	-	-	5
Front flipper (RFV)[2]	3	10	1	11	-	-	-	11
Hind flipper (RH1)[2]	3	6	1	7	-	-	-	7
R	3	6	5	11	2	-	2	13
Q	4	6	3	9	4	-	4	13
P	5	2	-	2	2	-	2	4
Females[3]								
S	2	1	3	4	3	-	3	7
Front flipper (RFV)[2]	3	14	-	14	-	-	-	14
Hind flipper (RH1)[2]	3	14	-	14	-	-	-	14
R	3	11	-	11	9	-	9	20
Q	4	65	21	86	36	-	36	122
P	5	35	22	57	25	-	25	82
O	6	73	34	107	21	-	21	128
N	7	47	19	66	-	-	-	66
M	8	12	4	16	-	-	-	16
L	9	11	1	12	-	-	-	12
K	10	14	3	17	-	-	-	17
J	11	8	2	10	-	-	-	10
I	12	1	1	2	-	-	-	2
H	13	11	-	11	-	-	-	11
G	14	3	-	3	-	-	-	3
F	15	1	-	1	-	-	-	1
E	16	2	1	3	-	-	-	3
B	20	2	-	2	-	-	-	2
A	21	1	-	1	-	-	-	1

1/ Seals tagged as pups were also marked by removing part of a flipper. The mark is used to identify seals that lose their tags. In addition to those seals listed, 23 males and 1 female recovered on St. Paul Island and 17 males recovered on St. George Island had lost their tag but did not have a checkmark.

2/ Seals marked but not tagged--V-notch right front flipper (RFV), tip of first digit right hind flipper sliced off (RH1), and tip of third digit right hind flipper sliced off (RH3).

3/ Tag loss from females older than 6 years cannot be determined from checkmarks.

Table A-33.--Tag recoveries[1] from male seals that had been selected and tagged as yearlings and at age 2 or older in previous years, Pribilof Islands, Alaska, 1968.

Age, year tagged, and tag series	Age when:		Total	Adjusted total[2]
	Tagged	Recovered		
Yearlings	Years	Years	Number	Number
1965				
1R	1	4	62	76
1R	2	5	3	4
1R	Unknown[3]		2	
Total			67	80
1966				
1S	1	3	251	311
1S	2	4	27	34
1S	Unknown[3]		14	
Total			292	345
1967				
1T	1	2	60	74
1T	2	3	25	32
1T	Unknown[3]		5	
Total			90	106
Age 2 and Older				
1966				
2S	2	4	96	119
2S	3	5	11	13
2S	Unknown[3]		5	
Total			112	132
1967				
2T	1	2	4	5
2T	2	3	396	483
2T	3	4	21	26
2T	Unknown[3]		14	
Total			435	514

[1] In addition to the seals listed, 166 males on St. Paul Island and 22 on St. George Island that had lost two tags were taken.

[2] See footnote 3, table 24.

[3] The tags were recovered but age could not be determined, either because the flippers or the heads were separated from the carcasses during the skin-stripping process.

Table A-34. --Recovery location of tagged male seals killed, by age and rookery, Pribilof Islands, Alaska, 26 June to 2 August 1968

Tag series, age, and rookery of tagging 1/	Rookery of recovery 1/												Grand total
	St. Paul Island							St. George Island					
	ZAP-1	TOL	L-K	REEF	POL	NEP	Total	ZAP-2	NOR	EAST	STAR	Total	
	Number							Number					
S-series - age 2													
ZAP-1	-	-	-	-	1	2	3	-	-	1	-	1	4
TZR	-	2	-	1	-	2	5	-	-	-	-	-	5
L-K	-	-	1	-	-	-	1	-	-	-	-	-	1
REEF	1	1	-	7	1	1	11	-	-	-	-	-	11
POL	1	-	-	-	-	-	1	-	-	-	-	-	1
NEP	-	3	-	1	-	3	7	-	-	-	-	-	7
ZAP-2	-	-	1	-	-	-	1	-	-	-	-	-	1
NOR	-	1	-	1	-	3	5	-	-	-	2	2	7
EAST	1	-	-	-	-	-	1	-	-	1	-	1	2
STAR	-	-	-	-	-	-	-	-	-	2	-	2	2
Tags lost	5	2	-	7	-	8	22	1	4	5	-	10	32
Total	8	9	2	17	2	19	57	1	4	9	2	16	73
R-series - age 3													
ZAP-1	17	32	4	4	-	4	61	3	-	-	2	5	66
TZR	10	17	2	5	-	4	38	2	1	-	2	5	43
L-K	2	6	3	7	-	2	20	-	-	4	-	4	24
REEF	7	11	1	36	1	1	57	1	1	1	-	3	60
POL	3	8	2	7	14	12	46	2	1	-	-	3	49
NEP	8	9	3	15	7	93	135	1	1	1	-	3	138
ZAP-2	-	-	-	-	-	-	-	-	-	-	-	-	-
NOR	-	1	-	-	-	-	1	-	-	-	-	-	1
EAST	-	-	-	-	-	-	-	-	-	-	1	1	1
STAR	-	-	-	-	-	-	-	-	-	-	-	-	-
Tags lost	26	46	18	34	15	32	171	7	16	4	-	27	198
Total	73	130	33	108	37	148	529	16	20	10	5	51	580
Q-series - age 4													
ZAP-1	63	36	1	6	3	7	116	2	2	1	-	5	121
TZR	10	35	-	4	-	2	51	2	-	-	-	2	53
L-K	5	8	16	5	2	6	42	-	3	-	-	3	45
REEF	16	35	4	70	4	5	134	3	2	1	-	6	140
POL	3	8	4	5	37	13	70	1	1	-	-	2	72
NEP	1	11	-	6	1	116	135	3	-	1	-	4	139
ZAP-2	6	3	-	1	1	1	12	31	8	11	-	50	62
NOR	1	3	1	1	-	2	8	2	37	3	1	43	51
EAST	4	-	-	2	-	2	8	1	3	20	-	24	32
STAR	-	1	-	-	1	2	4	2	9	4	8	23	27
Tags lost	53	74	18	45	20	62	272	10	17	5	4	36	308
Total	162	214	44	145	69	218	852	57	82	46	13	198	1,050
P-series - age 5													
ZAP-1	4	4	-	-	-	1	9	-	-	-	-	-	9
TZR	2	3	1	-	-	-	6	-	-	-	-	-	6
L-K	-	-	3	-	-	1	4	-	-	1	-	1	5
REEF	-	2	-	11	-	1	14	-	-	-	-	-	14
POL	1	-	-	1	5	-	7	-	-	-	-	-	7
NEP	1	-	-	-	-	11	12	-	-	-	-	-	12
ZAP-2	-	-	-	-	-	1	1	5	1	-	-	6	7
NOR	-	-	-	-	-	-	-	-	9	-	-	9	9
EAST	-	-	-	-	-	-	-	-	-	8	-	8	8
STAR	-	-	-	-	-	-	-	-	3	-	-	3	3
Tags lost	4	5	5	4	2	4	24	2	4	2	-	8	32
Total	12	14	9	16	7	19	77	7	17	11	-	35	112
O-series - age 6													
ZAP-1	1	-	-	-	-	-	1	-	-	-	-	-	1
REEF	-	-	-	1	-	-	1	-	-	-	-	-	1
POL	-	-	-	-	2	-	2	-	-	-	-	-	2
Tags lost	3	-	-	3	1	1	8	1	8	1	-	10	18
Total	4	-	-	4	3	1	12	1	8	1	-	10	22

1/ ZAP-1=Zapdni of St. Paul Island; TZR=Tolstoi and Zapadni Reef; L-K=Lukanin-Kitovi; REEF=Reef, Gorbatch, and Ardiguen; POL=Polovina, Polovina Cliffs, and Little Polovina; NEP=Northeast Point (Vostochni-Morjovi); NOR=North; EAST=East Cliffs and East Reef; STAR=Staraya Artil; ZAP-2=Zapadni of St. George Island.

2/ Pups were not tagged on St. George Island in 1965 (R-series tags).

Table A-35. --Recovery location of tagged female seals killed, by age and rookery, Pribilof Islands, Alaska, 26 June to 16 August 1968

Tag series, age, and rookery of tagging [1]	Rookery of recovery												Grand total
	St. Paul Island							St. George Island					
	ZAP-1	TZR	L-K	REEF	POL	NEP	Total	ZAP-2	NOR	EAST	STAR	Total	
	Number							Number					
S-series - age 2													
NOR	-	-	-	-	1	-	1	1	1	1	-	3	4
Tags lost	1	-	-	1	1	-	3	-	-	-	-	-	3
Total	1	-	-	1	2	-	4	1	1	1	-	3	7
R-series - age 3													
ZAP-1	2	1	-	-	-	-	3	-	-	-	-	-	3
L-K	-	-	-	1	-	-	1	-	-	-	-	-	1
REEF	-	-	-	3	-	-	3	-	-	-	-	-	3
POL	-	-	-	-	-	2	2	-	-	-	-	-	2
NEP	-	-	-	-	1	1	2	-	-	-	-	-	2
Tags lost	1	3	-	4	-	1	9	-	-	-	-	-	9
Total	3	4	-	8	1	4	20	-	-	-	-	-	20
Q-series - age 4													
ZAP-1	6	8	-	2	-	-	16	-	-	-	1	1	17
TZR	-	1	-	1	-	2	4	-	-	-	-	-	4
L-K	-	1	3	-	-	-	4	-	-	-	-	-	4
REEF	1	1	-	17	-	2	21	-	-	-	-	-	21
POL	1	-	1	1	5	2	10	-	-	-	-	-	10
NEP	1	2	-	-	-	6	9	1	-	-	-	1	10
ZAP-2	-	-	-	-	1	-	1	3	-	-	-	3	4
NOR	-	-	-	1	-	2	3	-	9	-	-	9	12
EAST	-	-	1	-	-	-	1	-	2	5	-	7	8
Tags lost	2	5	1	15	5	10	38	-	-	-	-	-	38
Total	11	18	6	37	11	24	107	4	11	5	1	21	128
P-series - age 5													
ZAP-1	8	2	-	1	-	-	11	-	-	-	1	1	12
REEF	1	-	1	9	-	-	11	-	-	-	-	-	11
POL	-	-	-	-	3	-	3	-	-	-	-	-	3
NEP	-	-	-	1	-	9	10	-	-	-	-	-	10
ZAP-2	1	-	-	-	-	-	1	3	-	1	-	4	5
NOR	-	-	-	-	-	-	-	-	14	-	-	14	14
EAST	-	-	-	-	-	-	-	-	-	4	-	4	4
Tags lost	1	4	-	13	3	8	29	-	-	-	-	-	29
Total	11	6	1	24	6	17	65	3	14	5	1	23	88
O-series - age 6													
ZAP-1	8	9	-	3	-	1	21	7	-	-	-	7	28
TZR	-	3	-	-	-	2	5	-	-	-	-	-	5
L-K	-	1	3	-	-	-	4	-	-	-	-	-	4
REEF	1	2	1	12	-	-	16	-	1	-	1	2	18
POL	-	1	-	-	12	-	13	-	-	-	-	-	13
NEP	-	-	-	-	2	14	16	-	-	-	-	-	16
ZAP-2	1	-	-	-	-	-	1	-	-	-	-	-	1
NOR	-	1	-	-	1	1	3	-	16	1	1	18	21
EAST	-	-	-	1	-	-	1	-	-	6	-	6	7
STAR	-	1	-	-	-	-	1	1	-	-	-	1	2
Tags lost	-	6	1	11	2	2	22	-	-	-	-	-	22
Total	10	24	5	27	17	20	103	8	17	7	2	34	137
N-series - age 7													
ZAP-1	7	6	-	-	2	1	16	-	-	-	-	-	16
TZR	1	2	-	-	-	2	5	-	-	-	-	-	5
L-K	-	1	1	-	-	-	2	-	-	-	-	-	2
REEF	1	1	-	7	-	-	9	-	-	-	-	-	9
POL	-	-	-	-	12	1	13	-	-	-	-	-	13
NEP	2	-	-	-	-	7	9	-	-	-	-	-	9
ZAP-2	-	-	-	-	-	-	-	3	-	-	-	3	3
NOR	-	-	-	-	-	-	-	-	11	1	-	12	12
EAST	-	-	-	-	-	-	-	-	-	1	-	1	1
STAR	-	-	-	-	-	-	-	1	1	-	1	3	3
Total	11	10	1	7	14	11	54	4	12	2	1	19	73

1/ See footnote end of table.

Table A-35. --Recovery location of tagged female seals killed, by age and rookery, Pribilof Islands, Alaska, 26 June to 16 August 1968--Continued

Tag series, age, and rookery of tagging [1]	Rookery of recovery												Grand total
	St. Paul Island							St. George Island					
	ZAP-1	TZR	L-K	REEF	POL	NEP	Total	ZAP-2	NOR	EAST	STAR	Total	
	Number							Number					
M-series - age 8													
ZAP-1	3	2	-	-	-	-	5	-	-	-	-	-	5
L-K	-	-	1	-	2	1	4	-	-	-	-	-	4
REEF	-	-	-	1	-	-	1	-	-	-	-	-	1
POL	-	-	-	-	1	-	1	-	-	-	-	-	1
NEP	-	-	-	-	-	1	1	-	-	-	-	-	1
ZAP-2	-	-	-	-	-	-	-	2	-	-	-	2	2
NOR	-	-	-	-	-	-	-	-	2	-	-	2	2
STAR	-	-	-	1	-	-	1	-	-	-	-	-	1
Total	3	2	1	2	3	2	13	2	2	-	-	4	17
L-series - age 9													
ZAP-1	3	1	-	1	-	-	5	-	-	-	-	-	5
TZR	-	-	-	-	-	1	1	-	-	-	-	-	1
L-K	-	-	-	-	-	1	1	-	-	-	-	-	1
REEF	-	-	-	4	-	-	4	-	-	-	-	-	4
POL	-	-	-	-	2	-	2	-	-	-	-	-	2
NEP	-	-	-	-	-	1	1	-	-	-	-	-	1
ZAP-2	-	-	-	-	-	-	-	1	-	-	-	1	1
Total	3	1	-	5	2	3	14	1	-	-	-	1	15
K-series - age 10													
ZAP-1	2	-	-	1	-	-	3	-	-	-	-	-	3
TZR	-	1	-	-	-	-	1	-	-	-	-	-	1
REEF	1	-	-	4	-	1	6	-	-	-	-	-	6
POL	-	-	-	-	2	-	2	-	-	-	-	-	2
NEP	1	-	-	-	-	3	4	-	-	-	-	-	4
NOR	-	-	-	1	-	-	1	-	3	-	-	3	4
Total	4	1	-	6	2	4	17	-	3	-	-	3	20
J-series - age 11													
ZAP-1	-	2	-	-	-	-	2	-	-	-	-	-	2
REEF	2	1	-	-	-	-	3	-	-	-	-	-	3
POL	-	-	-	-	1	-	1	-	-	-	-	-	1
NEP	-	-	-	-	-	2	2	-	-	-	-	-	2
ZAP-2	-	-	-	-	-	-	-	1	-	-	-	1	1
NOR	-	-	-	-	-	-	-	-	1	-	-	1	1
Total	2	3	-	-	1	2	8	1	1	-	-	2	10
I-series - age 12													
ZAP-1	1	-	-	-	-	-	1	-	-	-	-	-	1
TZR	-	-	-	1	-	-	1	-	-	-	-	-	1
NOR	-	-	-	-	-	1	1	-	1	-	-	1	2
Total	1	-	-	1	-	1	3	-	1	-	-	1	4
H-series - age 13													
ZAP-1	4	2	-	-	-	-	6	-	-	-	-	-	6
REEF	1	-	-	-	-	-	1	-	-	-	-	-	1
POL	-	-	-	-	2	-	2	-	-	-	-	-	2
NEP	-	-	-	-	-	2	2	-	-	-	-	-	2
Total	5	2	-	-	2	2	11	-	-	-	-	-	11
G-series - age 14													
ZAP-1	2	-	-	-	-	-	2	-	-	-	-	-	2
NEP	-	-	-	-	1	-	1	-	-	-	-	-	1
Total	2	-	-	-	1	-	3	-	-	-	-	-	3
F-series - age 15													
ZAP-1	1	-	-	-	-	-	1	-	-	-	-	-	1
E-series - age 16													
REEF	2	-	-	2	-	-	4	-	-	-	-	-	4
POL	-	-	-	-	-	-	-	1	-	-	-	1	1
Total	2	-	-	2	-	-	4	1	-	-	-	1	5
B-series - age 20													
POL	-	-	-	-	1	1	2	-	-	-	-	-	2
A-series - age 21													
REEF	-	-	-	1	-	-	1	-	-	-	-	-	1

1/ ZAP-1=Zapadni of St. Paul Island; TZR=Tolstoi and Zapadni Reef; L-K=Lukanin-Kitovi; REEF=Reef, Gorbatch, and Ardiguen; POL=Polovina, Polovina Cliffs, and Little Polovina; NEP=Northeast Point (Vostochni-Morjovi); NOR=North; EAST=East Cliffs and East Reef; STAR=Staraya Artil; ZAP-2=Zapadni of St. George Island.

Table A-36.--Soviet tags recovered in the United States kill of fur seals, Pribilof Islands, Alaska, 26 June to 5 August 1968

Island and date	Tag number	Age	Sex	Island of tagging	Rookery of recovery
		Years			
St. Paul Island					
9 July	Y-18923	2	M	Medny	Reef
1 Aug	Y-25820, Y-25847	2	M	Bering	Northeast Point
18 July	Y-32619	2	M	Medny	Reef
2 Aug	Y-33723	2	M	Medny	Reef
22 July	T-16962	3	M	Medny	Northeast Point
30 July	T-17058	3	M	Medny	Tolstoi-Zapadni Reef
30 July	T-17161	3	M	Medny	Tolstoi-Zapadni Reef
25 July	T-17228	3	M	Medny	Tolstoi-Zapadni Reef
13 Aug	T-17275	3	M	Medny	Tolstoi-Zapadni Reef
2 Aug	T-17612	3	M	Medny	Reef
27 June	T-17643	3	M	Medny	Northeast Point
29 July	T-17803	3	M	Medny	Reef
22 July	T-18274	3	M	Medny	Northeast Point
29 July	T-18416	3	M	Medny	Reef
1 Aug	T-19939	3	M	Medny	Northeast Point
15 Aug	T-20372	3	M	Medny	Polovina
29 July	T-20588	3	M	Medny	Reef
18 July	T-20628	3	M	Medny	Lukanin-Kitovi
2 Aug	T-21783	3	M	Medny	Reef
15 July	T-23514, T-23585	3	M	Medny	Zapadni
12 July	P-20542	4	M	Bering	Reef
31 July	P-22264	4	M	Bering	Zapadni
3 July	P-23174, P-23157	4	M	Bering	Tolstoi-Zapadni Reef
3 July	P-24143	4	M	Medny	Reef
2 Aug	P-24306	4	M	Medny	Reef
27 June	P-25252	4	M	Medny	Polovina
23 July	P-26933	4	M	Medny	Lukanin-Kitovi
29 July	P-31686	4	M	Medny	Reef
17 July	H-5265	5	M	Robben	Northeast Point
13 Aug	K-19955	6	F	Bering	Reef
13 Aug	C-48220	8	F	Medny	Tolstoi-Zapadni Reef
St. George Island					
29 July	Y-33907	2	M	Medny	Zapadni
26 July	T-23241, T-23281	3	M	Medny	North
30 July	P-19568	4	M	Bering	Zapadni
12 July	P-26546	4	M	Medny	Zapadni
17 July	P-27219	4	M	Medny	Zapadni
22 July	P-28798	4	M	Medny	North
28 June	H-27325, H-27799	5	M	Medny	North
17 July	H-28008	5	M	Medny	East

APPENDIX B

PERSONS ENGAGED IN FUR SEAL RESEARCH ON THE PRIBILOF ISLANDS IN 1968

Name	Work schedule on islands: Start	Work schedule on islands: Finish	Affiliation	Work
			Permanent employees	
Alton Y. Roppel	19 June	8 Aug.	Bureau of Commercial Fisheries	Seal research, general
Raymond E. Anas	19 June	1 Aug.	----------do.----------	Do.
Mark C. Keyes	3 July	1 Aug.	----------do.----------	Seal research, mortality
Fork Wilke	10 July	1 Aug.	----------do.----------	Laboratory Director
Lavrenty Stepetin	When needed for seal research		St. Paul Island resident	Seal research, general
			Temporary employees	
Don L. McClary	11 June	29 Aug.	School teacher	Seal research, general
Patrick Kozloff	17 June	4 Sept.	Student, U. of Alaska	Do.
Gilbert L. Moore	19 June	15 Aug.	School teacher	Do.
William Bemmel	26 June	4 Sept.	----------do.----------	Do.
Jerry S. Stearns	3 July	21 Aug.	Student, Oregon State U.	Do.
Thomas A. Gornall	3 July	15 Aug.	Student, Wash. State U.	Seal research, mortality
Dionsey Bourdukofsky	26 June	2 Oct.	St. Paul Island resident	Seal research, general
David Galaktionoff	26 June	2 Oct.	----------do.----------	Do.
Agafon Krukoff, Jr.	26 June	4 Sept.	----------do.----------	Do.
Ronald G. Pletnikoff	26 June	29 Aug.	----------do.----------	Do.
Perfenia Pletnikoff, Jr.	26 June	29 Aug.	----------do.----------	Do.
Anthony Merculief	26 June	29 Aug.	St. George Island resident	Do.

APPENDIX C

Table C-1.--Itinerary of pelagic investigations, 1967-68

Name	Vessel	Area of operation	Period
C. H. Fiscus.....	M/V Tonquin	Washington	27 Nov. to 21 Dec. 1967
Do.....	M/V New St. Joseph	Alaska	15 May to 21 June 1968
H. Kajimura.....	--------do.-------	Alaska	10 June to 16 July 1968
M. A. McCoy.....	--------do.-------	Alaska	21 June to 30 Aug. 1968
M. W. Marshall.....	M/V Tonquin	Washington	2 Jan. to 28 Feb. 1968
R. K. Stroud.....	----do.----	Washington	Do.
Do.....	M/V New St. Joseph	Alaska	15 July to 30 Aug. 1968
D. L. Ward.....	--------do.-------	Alaska	21 June to 30 Aug. 1968
M. A. Petterson....		Assisted in laboratory	

Table C-2.--List of chart squares occupied by a research vessel off Washington in November 1967, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V26-H 9..	0.3	0	0	0	V39-H12..	4.1	0	0	0
V26-H10..	0.5	0	0	0	V39-H13..	2.6	0	0	0
V27-H10..	0.8	0	0	0	V39-H14..	3.1	0	0	0
V27-H11..	1.2	1.7	2	0	V39-H15..	1.2	0	0	0
V28-H11..	0.2	0	0	0	V39-H16..	0.8	0	0	0
V37-H13..	0.2	0	0	0	V39-H17..	1.2	0	0	0
V37-H14..	0.7	0	0	0	V39-H18..	0.7	0	0	0
V38-H12..	0.8	0	0	0	V40-H12..	0.3	0	0	0
V38-H13..	2.6	0.4	1	0	V40-H13..	0.8	0	0	0
V38-H16..	0.2	0	0	0	V40-H16..	0.8	0	0	0
V38-H17..	0.2	0	0	0	V40-H17..	1.1	0	0	0
V39-H11..	2.2	0	0	0	V40-H18..	1.4	4.3	6	3

[1]The base chart is USCGS No. 5052. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 10) and vertical numbering at the lower left corner.

Table C-3.--List of chart squares occupied by a research vessel off Washington in December 1967, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected
	Number	Number	Number	Number
V26-H10	1.2	0.8	1	1
V26-H11	2.9	5.2	15	7
V27-H11	2.2	5.0	11	6
V28-H11	1.9	4.2	8	3
V28-H12	0.8	3.8	3	1
V29-H12	1.5	2.7	4	1
V30-H11	0.8	0	0	0
V30-H12	2.1	3.8	8	1
V31-H11	1.7	1.2	2	1
V32-H12	1.2	1.7	2	0
V33-H12	3.7	4.6	17	7
V34-H12	0.4	2.5	1	0
V34-H13	4.4	8.9	39	16
V35-H13	0.8	1.2	1	0
V35-H14	1.0	3.0	3	2
V36-H13	0.4	2.5	1	0
V36-H14	3.2	10.0	32	14
V36-H15	2.6	4.2	11	5
V37-H13	0.3	0	0	0
V37-H15	1.8	3.3	6	2
V37-H16	0.9	4.4	4	2
V38-H12	0.6	5.0	3	0
V38-H13	4.8	1.5	7	0
V38-H15	0.8	2.5	2	1
V38-H16	1.8	3.3	6	1
V38-H17	0.7	0	0	0
V39-H11	7.8	0	0	0
V39-H12	13.0	0.1	1	0
V39-H13	3.8	0.3	1	0
V39H-14	2.4	0	0	0
V39-H15	1.9	0	0	0
V39-H16	2.0	3.0	6	1
V39-H17	2.4	2.9	7	2
V39-H18	0.2	0	0	0
V40-H12	0.2	0	0	0
V40-H13	0.3	0	0	0
V40-H15	0.5	2.0	1	1
V40-H16	2.8	2.1	6	3
V40-H17	1.0	5.0	5	4
V40-H18	0.3	3.3	1	0

[1]The base chart is USCGS no. 5052. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 11) and vertical numbering at the lower left corner.

Table C-4.--List of chart squares occupied by a research vessel off Washington in January 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected
	Number	Number	Number	Number
V26-H 9	3.0	0.3	1	0
V26-H10	4.8	1.0	5	2
V26-H11	2.7	1.5	4	1
V27-H10	3.3	1.2	4	3
V27-H11	2.4	2.9	7	4
V28-H10	2.1	3.3	7	3
V28-H11	6.2	5.0	31	9
V28-H12	0.3	0.3	1	1
V29-H10	1.9	2.1	4	1
V29-H11	10.0	4.2	42	15
V29-H12	8.2	4.3	35	12
V30-H 9	0.5	0	0	0
V30-H10	4.2	1.7	7	2
V30-H11	16.7	6.8	113	26
V30-H12	6.2	4.4	27	6
V30-H13	0.9	1.1	1	0
V31-H11	1.5	1.3	2	2
V31-H13	2.4	2.5	6	2
V32-H11	1.6	5.0	8	2
V32-H13	1.4	0.7	1	0
V33-H11	1.5	7.3	11	4
V36-H13	1.7	1.2	2	0
V37-H13	2.5	3.2	8	3
V37-H14	1.2	0	0	0
V37-H15	2.7	1.8	5	1
V37-H16	1.0	1.0	1	0
V38-H12	0.5	0	0	0
V38-H13	4.2	3.1	13	6
V38-H14	0.8	1.2	1	1
V39-H10	0.7	0	0	0
V39-H11	11.8	0.7	8	4
V39-H12	12.4	0.3	4	2
V39-H13	2.2	2.3	5	0
V40-H12	1.3	6.9	9	2
V40-H13	3.6	0.3	1	0
V40-H14	1.2	0.8	1	1

[1]The base chart is USCGS no. 5052. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 12) and vertical numbering at the lower left corner.

Table C-5.--List of chart squares occupied by a research vessel off Washington in February 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V25-H11..	0.8	0	0	0	V33-H12..	10.7	10.1	108	50
V26-H 9..	5.6	1.4	8	2	V35-H13..	3.1	2.6	8	6
V26-H10..	10.1	3.4	34	17	V36-H13..	1.2	4.2	5	1
V26-H11..	16.7	3.2	54	20	V36-H14..	3.9	1.3	5	2
V27-H 9..	1.4	0	0	0	V36-H15..	1.4	0	0	0
V27-H10..	1.6	1.2	2	1	V37-H14..	1.5	2.0	3	3
V27-H11..	6.1	2.3	14	7	V37-H15..	1.1	0	0	0
V27-H12..	0.7	1.4	1	1	V38-H12..	1.2	0	0	0
V28-H 9..	1.2	0	0	0	V38-H13..	1.2	1.7	2	0
V28-H10..	0.4	0	0	0	V38-H14..	0.8	0	0	0
V28-H11..	1.2	8.3	10	4	V38-H15..	0.4	0	0	0
V28-H12..	2.1	3.3	7	5	V38-H16..	1.8	0	0	0
V29-H 9..	1.4	0.7	1	1	V38-H17..	0.8	1.2	1	1
V29-H10..	0.7	0	0	0	V39-H12..	0.4	0	0	0
V29-H11..	9.2	8.3	76	19	V39-H13..	0.3	3.3	1	0
V29-H12..	1.7	4.7	8	2	V39-H14..	1.6	0	0	0
V30-H 9..	0.9	1.1	1	0	V39-H15..	1.6	0.6	1	1
V30-H10..	5.8	0.5	3	1	V39-H16..	1.5	0.7	1	0
V30-H11..	5.8	1.7	10	1	V39-H17..	1.3	0	0	0
V30-H12..	4.5	6.7	30	5	V40-H16..	0.3	0	0	0
V31-H10..	0.5	0	0	0	V40-H17..	2.9	0.7	2	1
V31-H11..	3.2	5.3	17	2	V40-H18..	1.3	0	0	0
V31-H12..	4.8	7.1	34	12	V40-H19..	0.8	0	0	0
V32-H11..	1.0	14.0	14	3	V41-H19..	0.8	0	0	0
V32-H12..	1.2	15.0	18	6	V41-H20..	0.2	0	0	0

[1]The base chart is USCGS no. 5052. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 13) and vertical numbering at the lower left corner.

Table C-6.--List of chart squares occupied by a research vessel off Alaska (Area III) in May 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number	Number	Number	Number	Number	Number
V 1-H 4..	0.9	0	0	0	V16-H72..	0.9	0	0	0
V 1-H 5..	0.8	0	0	0	V17-H69..	1.5	0	0	0
V 1-H 6..	1.2	0	0	0	V17-H71..	1.9	0	0	0
V 1-H 7..	1.7	0.6	1	1	V17-H72..	2.3	0.4	1	1
V 1-H 8..	1.0	0	0	0	V18-H65..	1.5	0.7	1	1
V 2-H 8..	0.5	0	0	0	V18-H66..	0.9	1.1	1	1
V 2-H 9..	1.0	0	0	0	V18-H67..	0.9	0	0	0
V 3-H 9..	0.7	0	0	0	V18-H68..	1.2	0.8	1	1
V 6-H11..	1.0	0	0	0	V18-H69..	1.5	0	0	0
V 6-H12..	0.5	0	0	0	V18-H70..	1.1	0	0	0
V 7-H12..	0.7	0	0	0	V18-H71..	3.2	0	0	0
V 7-H13..	1.0	0	0	0	V18-H72..	0.4	0	0	0
V 7-H14..	0.2	0	0	0	V19-H29..	0.7	5.7	4	1
V 8-H14..	1.6	0	0	0	V19-H30..	3.3	2.1	7	4
V 9-H14..	0.2	0	0	0	V19-H31..	3.0	3.0	9	7
V 9-H15..	1.2	0	0	0	V19-H32..	2.5	8.0	20	3
V10-H15..	1.2	0	0	0	V19-H33..	1.1	18.0	20	3
V10-H73..	3.0	2.0	6	2	V19-H34..	1.3	12.0	15	0
V11-H16..	1.2	0	0	0	V19-H35..	1.2	3.3	4	0
V11-H72..	0.8	0	0	0	V19-H36..	1.4	7.8	11	0
V11-H73..	4.2	1.2	5	5	V19-H37..	1.2	10.8	13	0
V12-H16..	1.2	0	0	0	V19-H38..	0.7	1.4	1	0
V12-H70..	0.5	0	0	0	V19-H39..	0.3	3.3	1	0
V12-H71..	0.9	0	0	0	V19-H65..	0.5	0	0	0
V12-H72..	5.1	1.4	7	4	V19-H70..	1.9	0	0	0
V12-H73..	0.7	0	0	0	V19-H71..	1.4	0	0	0
V13-H16..	1.2	0	0	0	V20-H65..	1.2	0.8	1	0
V13-H69..	0.2	0	0	0	V20-H71..	1.7	0	0	0
V13-H70..	3.2	2.5	8	5	V21-H50..	1.2	0.8	1	0
V13-H71..	4.1	1.2	5	4	V21-H51..	2.4	2.9	7	6
V13-H72..	2.0	0	0	0	V21-H52..	1.6	5.0	8	5
V14-H16..	1.2	0	0	0	V21-H62..	2.3	2.2	5	4
V14-H69..	2.0	1.0	2	0	V21-H63..	1.8	1.1	2	2
V14-H70..	1.6	0.6	1	0	V21-H64..	5.7	3.2	18	9
V14-H72..	3.2	0.9	3	1	V21-H65..	1.9	0.5	1	0
V15-H15..	0.7	0	0	0	V22-H52..	0.5	2.0	1	0
V15-H16..	2.5	0	0	0	V22-H53..	1.7	1.2	2	1
V15-H17..	0.2	0	0	0	V22-H54..	1.2	0.8	1	1
V15-H69..	1.5	0.7	1	0	V22-H55..	1.3	2.3	3	2
V15-H70..	1.2	1.7	2	1	V22-H56..	1.0	0	0	0
V15-H73..	1.0	0	0	0	V22-H57..	1.0	2.0	2	1
V16-H15..	0.6	0	0	0	V22-H58..	0.7	2.8	2	2
V16-H17..	0.9	0	0	0	V22-H60..	0.3	6.6	2	2
V16-H18..	0.9	0	0	0	V22-H61..	4.5	2.2	10	7
V16-H19..	1.2	0.8	1	1	V22-H65..	5.5	2.2	12	6
V16-H20..	1.2	0.8	1	0	V23-H58..	1.2	0.8	1	0
V16-H21..	0.9	2.2	2	0	V23-H59..	3.2	0.9	3	1
V16-H68..	3.8	1.0	4	0	V23-H60..	2.2	0.9	2	0
V16-H70..	1.3	0	0	0					

[1]The base chart is USCGS no. 8500. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 14) and vertical numbering at the lower left corner.

Table C-7.--List of chart squares occupied by a research vessel off Alaska (Area III) in June 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V 2-H90	0.7	1.4	1	1	V 9-H77	1.0	3.0	3	1
V 3-H88	0.9	1.1	1	1	V 9-H78	1.3	0	0	0
V 3-H89	1.2	0	0	0	V 9-H79	1.3	0	0	0
V 3-H90	1.6	1.2	2	1	V 9-H80	1.5	0	0	0
V 4-H87	1.5	0.7	1	0	V10-H75	0.8	3.8	3	2
V 4-H88	0.7	0	0	0	V10-H76	0.5	0	0	0
V 5-H85	2.7	1.5	4	4	V11-H74	0.7	2.8	2	2
V 5-H86	1.5	0	0	0	V11-H75	0.9	2.2	2	2
V 6-H83	1.6	1.9	3	1	V12-H74	0.7	0	0	0
V 6-H84	1.2	0	0	0	V13-H73	0.7	0	0	0
V 7-H81	0.1	0	0	0	V13-H74	0.2	0	0	0
V 7-H82	1.2	0	0	0	V14-H73	1.2	0	0	0
V 7-H83	0.5	0	0	0	V15-H73	1.0	0	0	0
V 9-H76	0.8	0	0	0					

[1]The base chart is USCGS no. 8500. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 15) and vertical numbering at the lower left corner.

Table C-8.--List of chart squares occupied by a research vessel off Alaska (Area III) in August 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V 6-H87..	1.7	0.6	1	0	V17-H71..	1.7	0.6	1	0
V 7-H87..	0.7	0	0	0	V18-H43..	0.3	0	0	0
V 7-H86..	1.6	0.6	1	0	V18-H44..	1.2	0	0	0
V 8-H84..	1.0	0	0	0	V18-H45..	1.2	0	0	0
V 8-H85..	1.5	0.6	1	0	V18-H46..	1.2	0	0	0
V 9-H83..	1.0	0	0	0	V18-H47..	1.2	0	0	0
V 9-H84..	0.5	2.0	1	0	V18-H48..	1.2	0	0	0
V10-H80..	0.7	0	0	0	V18-H49..	1.2	0	0	0
V10-H81..	1.4	0	0	0	V18-H50..	1.3	0	0	0
V10-H82..	1.5	0.6	1	0	V18-H51..	1.2	0	0	0
V10-H83..	0.3	0	0	0	V18-H52..	0.4	0	0	0
V14-H71..	0.7	0	0	0	V18-H70..	0.8	1.2	1	0
V14-H72..	0.8	2.5	2	0	V18-H71..	0.7	0	0	0
V15-H71..	1.2	0.8	1	0	V19-H52..	0.9	0	0	0
V16-H71..	1.7	1.1	2	0	V19-H53..	0.7	0	0	0
V17-H24..	0.7	0	0	0	V19-H63..	0.7	0	0	0
V17-H25..	1.2	0.8	1	1	V19-H70..	1.0	0	0	0
V17-H26..	1.3	0	0	0	V20-H64..	1.1	0	0	0
V17-H27..	1.2	0	0	0	V20-H65..	1.1	0	0	0
V17-H28..	1.2	0	0	0	V20-H66..	1.1	0	0	0
V17-H29..	1.3	0	0	0	V20-H67..	1.0	0	0	0
V17-H30..	1.5	0	0	0	V20-H68..	1.2	0	0	0
V17-H31..	1.2	0	0	0	V20-H69..	1.2	0	0	0
V17-H32..	1.0	0	0	0	V20-H71..	1.5	0.6	1	0
V17-H33..	1.1	0	0	0	V21-H70.	1.5	0	0	0
V17-H34..	0.2	0	0	0	V21-H71..	0.7	0	0	0

[1]The base chart is USCGS no. 8500. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 18) and vertical numbering at the lower left corner.

Table C-9.--List of chart squares occupied by a research vessel off Alaska (Area IV) in June 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V27-H27..	1.4	2.1	3	3	V31-H18..	0.7	0	0	0
V28-H22..	5.3	1.9	10	7	V31-H19..	0.7	0	0	0
V28-H23..	2.2	1.4	3	2	V31-H20..	3.6	3.0	11	2
V28-H24..	1.5	10.0	15	6	V31-H21..	1.7	2.9	5	4
V28-H25..	1.9	6.8	13	4	V31-H22..	1.0	2.0	2	0
V28-H26..	13.6	2.8	38	19	V31-H23..	8.6	0.5	4	0
V28-H27..	5.0	4.2	21	2	V31-H24..	6.3	1.1	7	0
V28-H28..	4.2	3.1	13	0	V31-H25..	4.8	0	0	0
V28-H29..	1.7	1.2	2	0	V31-H26..	6.8	1.3	9	0
V29-H19..	0.6	0	0	0	V31-H27..	0.3	1.0	3	0
V29-H20..	0.7	0	0	0	V31-H28..	1.2	0	0	0
V29-H21..	6.0	1.5	9	3	V32-H 8..	2.2	3.2	7	6
V29-H22..	9.9	1.8	18	6	V32-H 9..	4.8	2.5	12	8
V29-H23..	8.1	2.1	17	9	V32-H10..	1.8	1.6	3	3
V29-H24..	6.4	0.6	4	0	V32-H11..	1.9	2.6	5	3
V29-H25..	1.4	1.4	2	2	V32-H12..	0.8	1.2	1	0
V29-H26..	4.8	1.4	7	0	V32-H14..	1.2	0	0	0
V29-H27..	3.8	3.2	12	0	V32-H15..	1.0	0	0	0
V29-H28..	2.8	0.4	1	0	V32-H18..	1.6	0	0	0
V30-H19..	1.6	0.6	1	0	V32-H19..	0.4	0	0	0
V30-H20..	1.6	0.6	1	0	V32-H20..	0.7	5.7	4	0
V30-H21..	6.8	2.2	15	9	V32-H23..	5.2	0.4	2	1
V30-H22..	14.5	1.4	20	6	V32-H24..	1.3	0	0	0
V30-H23..	10.9	0.7	8	1	V33-H 5..	2.2	2.2	5	1
V30-H24..	6.8	0.6	4	2	V33-H 6..	1.8	0.6	1	0
V30-H25..	4.6	0	0	0	V33-H 7..	1.2	0.3	3	1
V30-H26..	3.6	1.6	6	0	V33-H 8..	0.4	0	0	0
V30-H27..	7.5	2.9	22	0	V34-H 2..	2.2	3.6	8	4
V30-H28..	1.8	0.5	1	0	V34-H 3..	2.0	2.5	5	3
V31-H15..	0.5	0	0	0	V34-H 4..	2.0	0.5	1	0
V31-H16..	1.3	0	0	0	V35-H 1..	1.8	1.1	2	2
V31-H17..	1.8	1.1	2	0					

[1]The base chart is USCGS no. 8802. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 16) and vertical numbering at the lower corner.

Table C-10.--List of chart squares occupied by a research vessel off Alaska (Area IV) in July 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V27-H27..	0.7	0	0	0	V33-H26..	11.0	0.8	9	5
V28-H26..	1.7	1.7	3	3	V33-H27..	14.3	4.7	68	31
V28-H27..	2.6	3.8	10	4	V33-H28..	3.3	1.8	6	1
V28-H28..	3.0	2.0	6	2	V33-H30..	1.7	3.5	6	1
V29-H23..	2.1	0.9	2	1	V34-H24..	1.3	0.8	1	0
V29-H24..	2.3	1.3	3	1	V34-H25..	1.5	2.6	4	1
V29-H25..	0.6	5.0	3	1	V34-H26..	7.1	2.2	16	2
V29-H26..	3.1	1.0	3	3	V34-H27..	5.9	2.7	16	6
V29-H28..	2.6	0	0	0	V34-H28..	3.6	1.9	7	0
V30-H22..	0.9	0	0	0	V34-H30..	2.4	3.3	8	2
V30-H23..	3.2	1.8	6	2	V35-H24..	1.2	1.6	2	1
V30-H25..	2.5	2.8	7	2	V35-H25..	5.0	1.4	7	4
V30-H26..	1.9	1.6	3	1	V35-H26..	3.5	1.7	6	0
V30-H27..	0.8	1.2	1	0	V35-H27..	3.2	2.1	7	2
V30-H28..	4.2	0.2	1	0	V35-H28..	2.5	0.4	1	1
V30-H29..	3.7	0	0	0	V35-H29..	2.1	0.9	2	0
V31-H23..	6.3	0.9	6	0	V35-H30..	2.2	1.8	4	0
V31-H24..	4.4	0.9	4	1	V36-H24..	1.2	2.5	3	3
V31-H26..	1.7	3.5	6	0	V36-H25..	4.6	2.2	10	6
V31-H28..	3.2	0.3	1	0	V36-H26..	1.2	1.6	2	2
V31-H29..	7.8	1.1	9	2	V36-H27..	3.3	1.8	6	4
V32-H23..	0.3	0	0	0	V36-H28..	5.5	3.3	18	7
V32-H24..	10.8	2.7	29	2	V36-H29..	5.1	1.4	7	3
V32-H25..	5.1	1.0	5	0	V36-H30..	6.9	0.7	5	2
V32-H26..	13.2	0	0	0	V36-H31..	1.7	1.8	3	0
V32-H27..	4.0	0	0	0	V36-H32..	2.5	2.0	5	2
V32-H28..	6.7	0.4	3	1	V37-H25..	2.7	1.5	4	1
V32-H29..	1.2	0.8	1	1	V37-H29..	1.1	0	0	0
V32-H30..	1.2	4.2	5	1	V37-H30..	1.1	1.8	2	1
V33-H24..	2.4	1.6	4	2	V37-H31..	2.5	1.6	4	1
V33-H25..	12.4	1.1	14	6	V37-H32..	2.6	3.5	9	4

[1]The base chart is USCGS no. 8802. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 17) and vertical numbering at the lower left corner.

Table C-11.--List of chart squares occupied by a research vessel off Alaska (Area IV) in August 1968, showing hours in square, seals seen per hour, and number of seals seen and collected[1]

Square	Hours in square	Seals seen per hour	Seals		Square	Hours in square	Seals seen per hour	Seals	
			Seen	Collected				Seen	Collected
	Number	Number	Number	Number		Number	Number	Number	Number
V30-H14..	0.8	1.2	1	0	V33-H26..	2.8	1.1	3	0
V30-H15..	0.7	0	0	0	V33-H27..	14.2	5.8	82	36
V30-H22..	1.2	0.8	1	0	V33-H28..	1.8	3.3	6	1
V30-H23..	1.2	0	0	0	V33-H31..	2.2	15.9	35	5
V30-H24..	1.2	0.8	1	0	V34-H 4..	0.3	6.6	2	0
V30-H25..	1.1	0	0	0	V34-H25..	1.2	6.6	8	4
V30-H26..	1.2	1.6	2	0	V34-H26..	4.8	4.2	20	8
V30-H28..	1.0	0	0	0	V34-H27..	9.9	6.4	64	22
V31-H11..	1.2	2.5	3	0	V34-H28..	1.1	4.5	5	3
V31-H12..	1.1	2.7	3	0	V34-H31..	1.0	6.0	6	0
V31-H13..	1.0	3.0	3	0	V34-H32..	1.0	9.0	9	0
V31-H27..	1.2	0	0	0	V35-H32..	2.1	10.5	22	5
V31-H28..	3.9	0.5	2	1	V36-H33..	2.6	9.2	24	3
V31-H29..	0.7	0	0	0	V36-H34..	1.0	4.0	4	0
V32-H 7..	0.7	0.3	2	0	V37-H33..	1.2	20.0	24	0
V32-H 8..	0.9	1.1	1	0	V37-H34..	1.3	6.9	9	0
V32-H 9..	1.0	1.0	1	0	V38-H35..	2.3	6.5	15	0
V32-H10..	1.1	2.7	3	0	V39-H36..	1.8	18.3	33	0
V32-H26..	2.4	0	0	0	V40-H37..	1.2	11.7	14	0
V32-H27..	0.9	0	0	0	V41-H37..	1.3	3.0	4	0
V32-H28..	4.8	1.2	6	3	V42-H38..	1.6	2.5	4	0
V32-H30..	2.5	9.6	24	1	V43-H38..	0.2	0	0	0
V33-H 4..	0.9	0	0	0	V47-H40..	0.7	1.4	1	0
V33-H 5..	1.0	0.3	3	0	V48-H40..	0.5	6.0	3	0
V33-H 6..	0.9	1.1	1	0	V48-H41..	1.2	7.5	9	0
V33-H 7..	0.3	0	0	0	V49-H41..	0.2	35.0	7	0

[1]The base chart is USCGS no. 8802. The side of each chart square measures 18.52 km. (10 nautical miles); a square covers an area of 343 km.^{2} (100 square nautical miles). Squares are located by a system of vertical and horizontal numbers. Horizontal numbering begins at the lower right corner of the chart (fig. 18) and vertical numbering at the lower left corner.

Table C-12.--Total seals sighted, collected, wounded and lost, and killed and lost, 1958-68

Year	Total seals sighted[1]	Sighted seals					
		Collected		Wounded and lost		Killed and lost	
	Number	Number	Percent	Number	Percent	Number	Percent
1958.....	7,024	1,503	21.4	302	4.3	255	3.6
1959.....	5,919	1,548	26.2	316	5.3	286	4.8
1960.....	6,287	1,495	23.8	271	4.3	241	3.8
1961.....	3,415	1,352	40.0	176	5.2	124	3.6
1962.....	6,111	1,483	24.3	178	2.9	133	2.2
1963.....	5,790	1,355	23.4	202	3.5	143	2.5
1964.....	2,864	883	30.8	97	3.4	68	2.4
1965.....	1,627	419	27.8	50	3.1	45	2.8
1966.....	2,704	444	16.4	78	2.9	67	2.5
1967[2].....	897	132	14.7	27	3.0	22	2.5
1968[3].....	2,587	830	32.1	66	2.6	104	4.0
Total.....	45,225	11,444	25.3	1,763	3.9	1,488	3.3

[1]All seals sighted are not hunted.
[2]Includes 16 days during November and December 1966.
[3]Includes 25 days during November and December 1967.

Table C-13.--Number and percentage of seals shot at sea that were collected, wounded and lost, and killed and lost, 1958-68

Year	Total seals shot	Seals shot					
		Collected		Wounded and lost		Killed and lost	
	Number	Number	Percent	Number	Percent	Number	Percent
1958.....	2,060	1,503	73.0	302	14.6	255	12.4
1959.....	2,150	1,548	72.0	316	14.7	286	13.3
1960.....	2,007	1,495	74.5	271	13.5	241	12.0
1961.....	1,652	1,352	81.8	176	10.7	124	7.5
1962.....	1,794	1,483	82.7	178	9.9	133	7.4
1963.....	1,700	1,355	79.7	202	11.9	143	8.4
1964.....	1,048	883	84.3	97	9.3	68	6.4
1965.....	514	419	81.5	50	9.7	45	8.8
1966.....	589	444	75.4	78	13.2	67	11.4
1967[1].....	181	132	72.9	27	14.9	22	12.2
1968[2].....	1,000	830	83.0	66	6.6	104	10.4
Total.....	14,695	11,444	77.9	1,763	12.0	1,488	10.1

[1]Includes 16 days during November and December 1966.
[2]Includes 25 days during November and December 1967.

Table C-14.--Number of seals seen, and number seen per boat-hunting day, by 10-day periods, off Washington, 27 November 1967 to 26 February 1968

10-day period	Boat-hunting days[1]	Total seals seen	Seals seen per boat-hunting day	Seals seen per 10-day interval
	Number	Number	Number	Percent
21-30 Nov.	3.00	9	3.0	0.8
1-10 Dec.	3.25	12	3.7	1.1
11-20 Dec.	6.00	203	33.8	18.8
21-31 Dec.	No sealing			
1-10 Jan.	6.25	174	27.8	16.2
11-20 Jan.	2.25	11	4.9	1.0
21-31 Jan.	5.75	190	33.0	17.6
1-10 Feb.	5.50	311	56.5	28.9
11-20 Feb.	4.25	62	14.6	5.8
21-29 Feb.	3.00	106	35.3	9.8
Total	39.25	1,078	27.5	100.0

[1]A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Table C-15.--Number of seals seen, and number seen per boat-hunting day, by 10-day periods, in Alaska waters, 18 May to 24 August 1968

10-day period	Boat-hunting days[1]	Total seals seen	Seals seen per boat-hunting day	Seals seen per 10-day interval
	Number	Number	Number	Percent
11-20 May	2.50	7	2.8	0.5
21-31 May	9.50	245	25.8	16.2
1-10 June	7.00	89	12.7	5.9
11-20 June	4.75	130	27.4	8.6
21-30 June	9.00	171	19.0	11.3
1-10 July	6.50	105	16.2	6.9
11-20 July	7.00	113	16.1	7.5
21-31 July	6.50	165	25.4	10.9
1-10 Aug.	4.25	196	46.1	13.1
11-20 Aug.	6.25	287	45.9	19.0
21-31 Aug.	3.00	1	0.3	0.1
Total	66.25	1,509	22.8	100.0

[1]A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Table C-16.--Number of seals collected, and number collected per boat-hunting day, by 10-day periods, off Washington, 27 November 1967 to 26 February 1968

10-day period	Boat-hunting days[1]	Seals collected			Seals collected per boat-hunting day	
		Males	Females	Total		
	Number	Number	Number	Number	Number	Percent
21-30 Nov....	3.00	0	3	3	1.0	0.8
1-10 Dec....	3.25	0	0	0	0.0	0.0
11-20 Dec....	6.00	1	81	82	13.7	21.9
21-31 Dec....	No sealing					
1-10 Jan....	6.25	3	56	59	9.4	15.8
11-20 Jan....	2.25	4	1	5	2.2	1.3
21-31 Jan....	5.75	7	44	51	8.9	13.6
1-10 Feb....	5.50	4	104	108	19.6	29.0
11-20 Feb....	4.25	3	18	21	4.9	5.6
21-29 Feb....	3.00	12	33	45	15.0	12.0
Total.....	39.25	34	340	374	9.5	100.0

[1]A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Table C-17.--Number of seals collected, and number collected per boat-hunting day, by 10-day periods, in Alaska waters, 18 May to 24 August 1968

10-day period	Boat-hunting days[1]	Seals collected			Seals collected per boat-hunting day	
		Males	Females	Total		
	Number	Number	Number	Number	Number	Percent
11-20 May....	2.50	1	2	3	1.2	0.7
21-31 May....	9.50	28	69	97	10.2	21.2
1-10 June...	7.00	12	37	49	7.0	10.8
11-20 June...	4.75	7	37	44	9.3	9.7
21-30 June...	9.00	4	37	41	4.6	9.0
1-10 July...	6.50	7	14	21	3.2	4.6
11-20 July...	7.00	9	34	43	6.1	9.4
21-31 July...	6.50	10	55	65	10.0	14.2
1-10 Aug....	4.25	14	64	78	18.4	17.1
11-20 Aug....	6.25	0	14	14	2.2	3.1
21-31 Aug....	3.00	0	1	1	0.3	0.2
Total.....	66.25	92	364	456	6.9	100.0

[1]A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00

Table C-18.--Number of seals per group among 1,078 seals sighted off Washington, 27 November 1967 to 26 February 1968

Number of seals in group	Groups	Seals	
	Number	Number	Percent
1.....	440	440	40.8
2.....	134	268	24.9
3.....	49	147	13.6
4.....	25	100	9.3
5.....	11	55	5.1
6.....	6	36	3.3
7.....	2	14	1.3
9.....	2	18	1.7
Total.....	669	1,078	100.0

Table C-19.--Number of seals per group among 1,509 seals sighted in Alaska waters, 18 May to 24 August 1968

Number of seals in group	Groups	Seals	
	Number	Number	Percent
1.....	1,025	1,025	68.0
2.....	168	336	22.2
3.....	35	105	7.0
4.....	7	28	1.8
5.....	3	15	1.0
Total....	1,238	1,509	100.0

Table C-20.--Thickness of subcutaneous fat in yearling[1/] fur seals collected pelagically off Washington, 1968

US-68 field number	Date collected	Sex	Measurement of fat thickness		Body		Remarks	Examiner[2/]
			Sternum	Pelvic	Length	Weight		
			Mm.	Mm.	Cm.	Kg.		
	Jan.							
5	3	F	17	13	75	8.0	Frozen, examined in lab.	MK
10	3	F	1	0	72	6.0	--------do. ----------	MK
30	3	F	17	11	70	6.5	--------do. ----------	MK
33	4	F	25	18	78	9.5	--------do. ----------	MK
53	8	F	17	6	70	8.0	--------do. ----------	MK
56	8	F	34	8	78	7.5	--------do. ----------	MK
57	10	M	29	21	80	10.0	--------do. ----------	MK
58	10	M	13	9	84	10.0	--------do. ----------	MK
61	12	M	11	9	82	9.0	--------do. ----------	MK
62	13	M	10	3	74	7.5	--------do. ----------	MK
63	13	M	20	12	86	13.0	--------do. ----------	MK
65	21	F	20	13	77	10.0	--------do. ----------	MK
69	21	M	22	10	79	10.5	--------do. ----------	MK
71	21	F	21	20	80	11.5	--------do. ----------	MK
72	21	M	25	8	81	10.5	--------do. ----------	MK
79	23	M	5	0	79	9.5	--------do. ----------	MK
81	23	M	8	0	76	8.0	--------do. ----------	MK
82	23	F	16	8	68	6.5	--------do. ----------	MK
85	23	F	25	13	74	8.5	--------do. ----------	MK
88	27	F	0	0	78	8.0	Blubber too thin to measure	RKS
89	27	F	0	0	75	8.0	--------do. ----------	RKS
93	30	M	9	5	77	9.0	Not frozen, examined in field	RKS
98	30	F	0	0	78	5.0	Found floating dead in water, carcass frozen, examined at lab, animal in poor shape	MK
99	30	F	16	13	78	10.0	Examined in field, not frozen	RKS
101	30	F	1	1	72	6.0	--------do. ----------	RKS
	Feb.							
116	1	F	1	1	74	8.0	--------do. ----------	RKS
120	5	F	8	4	73	8.0	--------do. ----------	RKS
121	7	F	20	16	74	10.0	--------do. ----------	RKS
124	7	F	14	12	71	8.0	--------do. ----------	RKS
133	7	F	8	6	76	7.0	--------do. ----------	RKS
146	8	M	7	3	87	12.0	--------do. ----------	RKS
147	8	M	5	2	87	10.0	--------do. ----------	RKS
148	8	F	13	10	75	8.5	--------do. ----------	RKS
175	10	F	12	10	79	8.0	--------do. ----------	RKS
176	10	F	16	10	72	9.0	--------do. ----------	RKS
177	10	F	17	12	81	10.0	--------do. ----------	RKS
178	10	F	13	10	80	10.0	--------do. ----------	RKS
180	10	F	1	1	70	8.0	--------do. ----------	RKS
181	10	M	20	15	80	10.0	--------do. ----------	RKS
192	10	F	25	16	78	10.0	--------do. ----------	RKS
215	10	F	12	10	69	6.0	--------do. ----------	RKS
217	10	F	15	11	72	9.0	--------do. ----------	RKS
221	10	F	14	9	79	9.0	--------do. ----------	RKS
223	10	F	20	18	72	8.0	--------do. ----------	RKS
224	11	F	12	9	75	8.0	--------do. ----------	RKS
225	11	M	14	7	82	10.5	--------do. ----------	RKS
227	11	F	15	12	82	11.0	--------do. ----------	RKS
231	14	F	13	7	74	8.5	--------do. ----------	RKS
232	15	M	9	10	81	9.5	--------do. ----------	RKS
233	15	F	13	9	75	7.5	--------do. ----------	RKS
239	20	F	16	10	75	10.0	--------do. ----------	RKS
245	22	M	4	5	81	9.5	--------do. ----------	RKS
249	22	F	19	16	78	9.0	--------do. ----------	RKS
255	22	F	13	11	81	9.0	--------do. ----------	RKS
256	22	F	14	7	78	10.5	--------do. ----------	RKS
257	25	M	16	13	81	12.0	--------do. ----------	RKS
258	25	M	10	8	84	10.5	--------do. ----------	RKS
260	25	F	10	8	71	8.0	--------do. ----------	RKS
261	25	F	16	13	75	8.0	--------do. ----------	RKS
263	25	M	15	11	75	10.0	--------do. ----------	RKS
264	25	M	12	9	79	10.0	--------do. ----------	RKS
265	25	M	21	8	86	10.0	Frozen, examined in lab.	MK
266	25	F	18	11	75	6.5	--------do. ----------	MK
267	25	M	23	12	77	7.0	--------do. ----------	MK
269	25	F	15	3	71	6.0	--------do. ----------	MK
270	25	M	25	12	78	7.0	--------do. ----------	MK
272	25	M	12	10	82	8.0	Examined in field, not frozen	RKS
273	25	M	0	0	82	7.0	Frozen, examined in lab.	MK
276	25	M	16	14	85	10.0	Examined in field, not frozen	RKS
280	25	F	10	6	70	5.5	---------do. ----------	RKS
281	25	F	15	10	75	6.0	Frozen, examined in lab.	MK
282	25	F	20	11	75	8.0	-------do. ----------	MK
286	26	F	10	6	75	6.0	Examined in field, not frozen	RKS

1/ These seals were born in late June and July 1967.

2/ MK=Mark Keyes; RKS= Richard K. Stroud.

Table C-21. --Monthly mean lengths of pregnant fur seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	November		December		January		February		May		June		July	
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.
4	-	-	-	-	1	110.0	-	-	-	-	2	118.5	-	-
5	-	-	2	121.5	1	116.0	4	119.5	1	119.0	2	124.0	2	119.5
6	1	117.0	3	122.3	5	121.8	11	122.2	1	125.0	10	125.4	1	123.0
7	-	-	5	125.2	5	124.4	9	125.8	6	128.0	11	126.1	5	122.4
8	-	-	7	125.1	4	127.0	1	123.0	3	127.3	9	126.7	2	126.5
9	1	133.0	7	125.9	5	124.6	7	129.7	3	130.3	5	126.8	1	133.0
10	-	-	1	126.0	8	129.5	8	127.5	3	133.0	7	131.9	3	125.0
11	-	-	4	129.0	4	125.7	9	128.0	4	125.7	9	131.4	1	138.0
12	-	-	5	130.6	8	127.2	7	127.3	6	131.8	7	131.7	-	-
13	-	-	1	130.0	2	124.5	2	131.5	6	129.8	4	135.0	1	134.0
14	-	-	1	144.0	1	125.0	3	130.7	4	133.5	5	133.4	2	122.0
15	-	-	2	132.0	3	133.0	7	132.6	1	123.0	6	124.8	-	-
16	-	-	2	136.5	4	128.2	4	127.2	4	128.5	5	134.0	-	-
17	-	-	-	-	4	127.2	1	119.0	2	134.0	5	133.8	2	129.5
18	-	-	2	127.5	-	-	1	130.0	2	137.5	2	134.5	-	-
19	-	-	2	136.5	-	-	-	-	2	129.0	1	125.0	-	-
20	-	-	1	129.0	-	-	-	-	1	131.0	1	127.0	-	-
21	-	-	-	-	-	-	-	-	1	126.0	-	-	-	-
Total	2		45		55		74		50		91		20	

Table C-22. --Monthly mean weights of pregnant fur seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	November		December		January		February		May		June		July	
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.
4	-	-	-	-	1	26.0	-	-	-	-	2	36.5	-	-
5	-	-	2	30.5	1	23.0	4	27.2	1	33.5	2	37.7	2	42.7
6	1	25.0	3	28.3	5	32.8	11	32.0	1	38.5	10	39.6	1	41.0
7	-	-	5	29.0	5	33.4	9	34.6	6	41.0	11	42.7	5	42.8
8	-	-	7	31.6	4	33.9	1	32.0	3	39.7	9	45.4	2	47.0
9	1	40.0	7	34.0	5	35.5	7	38.4	3	44.5	5	45.0	1	54.0
10	-	-	1	40.0	8	38.4	8	38.1	3	45.3	7	49.3	3	51.8
11	-	-	4	36.2	4	39.2	9	36.7	4	42.0	9	48.9	1	56.0
12	-	-	5	36.0	8	38.4	7	37.9	6	46.4	7	49.1	-	-
13	-	-	1	37.0	2	36.5	2	39.5	6	44.3	4	50.7	1	56.0
14	-	-	1	45.0	1	40.0	3	44.0	4	51.1	5	51.6	2	52.7
15	-	-	2	39.5	3	43.7	7	43.0	1	41.0	6	47.8	-	-
16	-	-	2	42.0	4	40.5	4	40.7	4	45.5	5	51.4	-	-
17	-	-	-	-	4	45.5	1	30.0	2	48.0	5	51.7	2	48.2
18	-	-	2	35.0	-	-	1	37.0	2	54.0	2	56.5	-	-
19	-	-	2	41.5	-	-	-	-	2	47.5	1	47.0	-	-
20	-	-	1	37.0	-	-	-	-	1	47.0	1	47.0	-	-
21	-	-	-	-	-	-	-	-	1	42.0	-	-	-	-
Total	2		45		55		74		50		91		20	

Table C-23. --Monthly mean lengths of post partum fur seals collected pelagically by the United States in the eastern Pacific, 1968

Age	June		July		August		Combined length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean	Standard deviation
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.
4	-	-	-	-	2	115.0	2	115.0	4.2
5	-	-	1	112.0	1	116.0	2	114.0	2.8
6	-	-	2	120.0	2	122.5	4	121.2	6.4
7	-	-	2	121.0	7	125.1	9	124.2	6.8
8	1	123.0	1	126.0	2	124.0	4	124.2	3.5
9	-	-	2	125.0	2	123.5	4	124.2	2.8
10	-	-	-	-	1	127.0	1	127.0	-
11	-	-	1	127.0	2	124.0	3	125.0	2.6
12	-	-	-	-	3	127.3	3	127.3	1.2
13	-	-	2	128.0	2	118.5	4	123.2	5.9
14	-	-	2	126.0	3	126.0	5	126.0	6.2
15	-	-	4	123.7	3	131.3	7	127.0	7.7
16	-	-	1	130.0	5	134.2	6	133.5	8.6
17	-	-	1	123.0	2	127.5	3	126.0	2.6
18	-	-	1	123.0	-	-	1	123.0	-
19	-	-	1	129.0	-	-	1	129.0	-
20	-	-	-	-	2	125.0	2	125.0	2.8
Total	1		21		39		61		

Table C-24. --Monthly mean weights of post partum fur seals collected pelagically by the United States in the eastern Pacific, 1968

Age	June		July		August		Combined weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean	Standard deviation
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.
4	-	-	-	-	2	26.0	2	26.0	3.5
5	-	-	1	26.0	1	22.0	2	24.0	2.8
6	-	-	2	30.7	2	33.7	4	32.2	2.3
7	-	-	2	34.2	7	33.8	9	33.9	3.3
8	1	33.5	1	37.0	2	35.7	4	35.5	3.4
9	-	-	2	33.5	2	29.0	4	31.2	2.9
10	-	-	-	-	1	32.0	1	32.0	-
11	-	-	1	31.5	2	34.7	3	33.7	4.2
12	-	-	-	-	3	37.3	3	37.3	2.0
13	-	-	2	47.2	2	32.0	4	39.6	8.8
14	-	-	2	35.2	3	34.5	5	34.8	3.8
15	-	-	4	42.6	3	40.5	7	41.7	4.9
16	-	-	1	41.0	5	43.3	6	42.9	4.0
17	-	-	1	37.0	2	40.7	3	39.5	2.3
18	-	-	1	40.0	-	-	1	40.0	-
19	-	-	1	50.0	-	-	1	50.0	-
20	-	-	-	-	2	37.5	2	37.5	3.5
Total	1		21		39		61		

Table C-25. --Monthly mean lengths of nonpregnant female seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	November		December		January		February		May		June		July		August	
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.
1	-	-	-	-	15	74.9	32	75.0	-	-	-	-	-	-	-	-
2	1	91.0	3	92.3	1	86.0	2	87.5	1	99.0	-	-	1	95.0	-	-
3	-	-	7	102.1	2	102.5	4	102.7	3	103.0	-	-	9	105.6	10	109.3
4	-	-	11	111.5	15	110.4	18	111.2	5	110.4	6	114.2	18	113.7	17	112.3
5	-	-	2	115.5	5	118.0	3	121.7	3	110.7	2	114.0	6	118.0	2	119.0
6	-	-	1	123.0	1	124.0	1	114.0	1	99.0	-	-	5	125.6	2	122.0
7	-	-	5	123.4	4	123.5	7	124.7	-	-	-	-	3	122.3	-	-
8	-	-	1	129.0	-	-	1	131.0	-	-	3	123.7	2	123.5	1	125.0
9	-	-	1	131.0	2	135.0	2	127.0	1	127.0	-	-	1	127.0	-	-
10	-	-	2	118.0	1	131.0	3	129.3	-	-	-	-	3	125.7	-	-
11	-	-	1	121.0	-	-	3	129.0	1	127.0	-	-	-	-	-	-
12	-	-	-	-	-	-	2	130.0	-	-	1	129.0	1	124.0	-	-
13	-	-	-	-	-	-	-	-	1	135.0	-	-	2	129.0	1	128.0
14	-	-	-	-	-	-	1	130.0	1	135.0	-	-	2	124.5	1	126.0
15	-	-	-	-	-	-	1	142.0	-	-	1	138.0	1	134.0	1	124.0
16	-	-	-	-	-	-	-	-	1	132.0	-	-	-	-	-	-
17	-	-	-	-	-	-	1	124.0	-	-	-	-	1	121.0	2	137.5
18	-	-	-	-	-	-	-	-	-	-	1	133.0	1	120.0	1	127.0
19	-	-	-	-	-	-	-	-	-	-	1	121.0	2	129.0	1	127.0
20	-	-	-	-	-	-	-	-	1	134.0	-	-	-	-	1	124.0
21	-	-	-	-	-	-	-	-	-	-	-	-	2	126.5	-	-
22	-	-	1	135.0	-	-	-	-	1	132.0	-	-	1	127.0	-	-
23	-	-	1	135.0	-	-	-	-	-	-	-	-	-	-	-	
Total	1		36		46		81		20		15		61		40	

Table C-26. --Monthly mean weights of nonpregnant female seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	November		December		January		February		May		June		July		August	
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.
1	-	-	-	-	15	7.9	32	8.2	-	-	-	-	-	-	-	-
2	1	13.0	3	13.0	1	11.0	2	10.5	1	18.0	-	-	1	15.0	-	-
3	-	-	7	17.0	2	18.0	4	18.9	3	17.7	-	-	9	21.0	10	23.0
4	-	-	11	22.3	15	22.7	18	23.2	5	22.1	6	25.3	18	26.7	17	25.9
5	-	-	2	24.0	5	28.2	3	29.3	3	24.0	2	29.0	6	29.2	2	29.2
6	-	-	1	30.0	1	30.0	1	28.0	1	30.0	-	-	5	34.6	2	32.0
7	-	-	5	32.4	4	30.5	7	32.3	-	-	-	-	3	31.8	-	-
8	-	-	1	32.0	-	-	1	38.0	-	-	3	33.0	2	37.2	1	32.0
9	-	-	1	37.0	2	42.5	2	35.0	1	32.5	-	-	1	31.0	-	-
10	-	-	2	29.5	1	41.0	3	34.3	-	-	-	-	3	33.8	-	-
11	-	-	1	30.0	-	-	3	35.8	1	36.0	-	-	-	-	-	-
12	-	--	-	-	-	-	2	35.5	-	-	1	44.0	1	32.0	-	-
13	-	-	-	-	-	-	-	-	1	41.0	-	-	2	41.7	1	37.0
14	-	-	-	-	-	-	1	36.0	1	38.5	-	-	2	39.2	1	41.0
15	-	-	-	-	-	-	1	46.0	-	-	1	49.0	1	34.5	1	41.0
16	-	-	-	-	-	-	-	-	1	40.0	-	-	-	-	-	-
17	-	-	-	-	-	-	1	43.0	-	-	-	-	1	38.5	2	47.7
18	-	-	-	-	-	-	-	-	-	-	1	44.0	1	30.0	1	32.0
19	-	-	-	-	-	-	-	-	-	-	1	41.5	2	44.7	1	38.0
20	-	-	-	-	-	-	-	-	1	40.0	-	-	-	-	1	36.5
21	-	-	-	-	-	-	-	-	-	-	-	-	2	41.7	-	-
22	-	-	1	34.0	-	-	-	-	1	43.5	-	-	1	49.5	-	-
23	-	-	1	43.0	-	-	-	-	-	-	-	-	-	-	-	-
T	1		36		46		81		20		15		61		40	

Table C-27. --Monthly mean lengths of male seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	December		January		February		May		June		July		August	
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.
1	-	-	11	80.5	16	81.7	2	90.5	-	-	-	-	-	-
2	-	-	-	-	1	101.0	8	98.0	1	105.0	6	103.0	5	105.8
3	-	-	2	112.5	2	109.5	9	111.7	12	114.9	13	113.8	3	117.7
4	1	119.0	1	114.0	-	-	6	121.3	2	128.5	3	121.7	1	116.0
5	-	-	-	-	-	-	2	122.0	3	133.7	1	135.0	-	-
6	-	-	-	-	-	-	1	149.0	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	2	161.0	1	177.0	-	-
9	-	-	-	-	-	-	-	-	-	-	1	126.0	2	176.5
10	-	-	-	-	-	-	-	-	1	184.0	1	178.0	-	-
11	-	-	-	-	-	-	1	189.0	1	200.0	-	-	-	-
13	-	-	-	-	-	-	-	-	1	186.0	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	1	190.0
16	-	-	-	-	-	-	-	-	-	-	-	-	1	179.0
17	-	-	-	-	-	-	-	-	-	-	-	-	1	191.0
Total	1		14		19		29		23		26		14	

Table C-28. --Monthly mean weights of male seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	December		January		February		May		June		July		August	
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.
1	-	-	11	9.9	16	9.6	2	14.5	-	-	-	-	-	-
2	-	-	-	-	1	19.0	8	17.3	1	19.0	6	20.3	5	22.1
3	-	-	2	23.0	2	22.5	9	24.6	12	25.7	13	28.2	3	32.7
4	1	31.0	1	27.0	-	-	6	29.6	2	40.0	3	35.5	1	30.0
5	-	-	-	-	-	-	2	35.5	3	44.3	1	53.0	-	-
6	-	-	-	-	-	-	1	61.0	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	2	79.5	1	98.0	-	-
9	-	-	-	-	-	-	-	-	-	-	1	39.0	2	101.2
10	-	-	-	-	-	-	-	-	1	158.0	1	105.0	-	-
11	-	-	-	-	-	-	1	207.0	1	213.0	-	--	-	--
13	-	-	-	-	-	-	-	-	1	185.0	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	1	137.0
16	-	-	-	-	-	-	-	-	-	-	-	-	1	107.0
17	-	-	-	-	-	-	-	-	-	-	-	-	1	145.0
Total	1		14		19		29		23		26		14	

Table C-29.--Monthly mean lengths (crown rump) and weights of fur seal fetuses collected pelagically by the United States off Washington, 1967-68[1]

Period	Male			Female		
	Fetuses	Mean length	Mean weight	Fetuses	Mean length	Mean weight
	Number	Cm.	G.	Number	Cm.	G.
21-30 Nov..	1	5.0	5.2	1	1.8	0.7
11-21 Dec..	17	6.3	10.0	27	5.2	7.7
1-10 Jan..	6	8.3	24.8	5	7.3	19.7

[1]Measurements were taken after the fetuses were preserved in formaldehyde.

Table C-30.--Monthly mean lengths and weights of fur seal fetuses collected pelagically by the United States in the eastern Pacific, 1968[1]

Period	Male			Female		
	Fetuses	Mean length	Mean weight	Fetuses	Mean length	Mean weight
	Number	Cm.	Kg.	Number	Cm.	Kg.
1-10 Jan..	10	13.9	0.1	8	14.8	0.1
21-30 Jan..	5	20.9	0.2	12	21.0	0.3
1-10 Feb..	22	28.0	0.6	26	24.8	0.4
11-20 Feb..	3	29.2	0.7	3	28.7	0.6
21-28 Feb..	8	30.9	0.7	3	31.0	0.7
21-30 May..	24	59.1	4.3	26	56.6	3.7
1-10 June.	14	61.1	4.8	17	59.6	4.3
11-20 June.	14	64.1	5.5	21	60.3	5.0
21-30 June.	9	64.4	5.9	16	61.3	4.9
1-10 July.	8	63.6	5.9	2	60.7	5.2
11-20 July.	4	64.6	5.8	3	60.7	5.1
21-30 July.	--	--	--	3	62.3	5.5
Total....	121			140		

[1]Measurements were taken from fetuses not preserved in formaldehyde.

Table C-31.--Reproductive condition of female seals collected pelagically by the United States in the eastern Pacific, 1967-68

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
November								
2	1	-	-	-	-	-	-	1
6	-	-	1	100.0	-	-	-	1
9	-	-	-	-	-	1	100.0	1
Total	1	-	1		-	1		3
Percent				100.0			100.0	
December								
2	3	-	-	-	-	-	-	3
3	7	-	-	-	-	-	-	7
4	11	-	-	--	-	-	-	11
5	2	-	2	100.0	-	-	-	4
6	1	-	2	100.0	-	1	100.0	4
7	2	-	4	100.0	3	1	25.0	10
8	-	1	2	66.7	-	5	100.0	8
9	-	-	-	-	1	7	87.5	8
10	-	-	-	-	2	1	33.3	3
11	-	-	-	-	1	4	80.0	5
12	-	-	-	-	-	5	100.0	5
13	-	-	-	-	-	1	100.0	1
14	-	-	-	-	-	1	100.0	1
15	-	-	-	-	-	2	100.0	2
16	-	-	-	-	-	2	100.0	2
18	-	-	-	-	-	2	100.0	2
19	-	-	-	-	-	2	100.0	2
20	-	-	-	-	-	1	100.0	1
22	-	-	-	-	1	-	0.0	1
23	-	-	-	-	1	-	0.0	1
Total	26	1	10		9	35		81
Percent				90.9			79.5	
January								
1	15	-	-	-	-	-	-	15
2	1	-	-	-	-	-	-	1
3	2	-	-	-	-	-	-	2
4	15	-	1	100.0	-	-	-	16
5	5	-	1	100.0	-	-	-	6
6	1	-	4	100.0	-	1	100.0	6
7	4	-	-	-	-	5	100.0	9
8	-	-	-	-	-	4	100.0	4
9	-	-	-	-	2	5	71.4	7
10	-	-	-	-	1	8	88.9	9
11	-	-	-	-	-	4	100.0	4
12	-	-	-	-	-	8	100.0	8
13	-	-	-	-	-	2	100.0	2
14	-	-	-	-	-	1	100.0	1
15	-	-	-	-	-	3	100.0	3
16	-	-	-	-	-	4	100.0	4
17	-	-	-	-	-	4	100.0	4
Total	43	-	6		3	49		101
Percent				100.0			94.2	
February								
1	32	-	-	-	-	-	-	32
2	2	-	-	-	-	-	-	2
3	4	-	-	-	-	-	-	4
4	18	-	-	-	-	-	-	18
5	3	-	4	100.0	-	-	-	7
6	1	-	6	100.0	-	5	100.0	12
7	5	1	2	66.7	1	7	87.5	16
8	-	-	-	-	1	1	50.0	2
9	-	1	-	0.0	1	7	87.5	9
10	-	-	-	-	3	8	72.7	11
11	-	-	1	100.0	3	8	72.7	12
12	-	-	-	-	2	7	77.8	9
13	-	-	-	-	-	2	100.0	2
14	-	-	-	-	1	3	75.0	4
15	-	-	-	-	1	7	87.5	8
16	-	-	-	-	-	4	100.0	4
17	-	-	-	-	1	1	50.0	2
18	-	-	-	-	-	1	100.0	1
Total	65	2	13		14	61		155
Percent				86.7			81.3	

Table C-31. --Reproductive condition of female seals collected pelagically by the United States in the eastern Pacific, 1967-68--Continued

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				May				
2	1	-	-	-	-	-	-	1
3	3	-	-	-	-	-	-	3
4	5	-	-	-	-	-	-	5
5	3	-	1	100.0	-	-	-	4
6	-	1	-	0.0	-	1	100.0	2
7	-	-	1	100.0	-	5	100.0	6
8	-	-	-	-	-	3	100.0	3
9	-	-	-	-	1	3	75.0	4
10	-	-	-	-	-	3	100.0	3
11	-	-	-	-	1	4	80.0	5
12	-	-	-	-	-	6	100.0	6
13	-	-	-	-	1	6	85.7	7
14	-	-	-	-	1	4	80.0	5
15	-	-	-	-	-	1	100.0	1
16	-	-	-	-	1	4	80.0	5
17	-	-	-	-	-	2	100.0	2
18	-	-	-	-	-	2	100.0	2
19	-	-	-	-	-	2	100.0	2
20	-	-	-	-	1	1	50.0	2
21	-	-	-	-	-	1	100.0	1
22	-	-	-	-	1	-	0.0	1
Total	12	1	2		7	48		70
Percent				66.7			87.3	
				June				
4	6	-	2	100.0	-	-	-	8
5	2	-	1	100.0	-	1	100.0	4
6	-	-	5	100.0	-	5	100.0	10
7	-	-	1	100.0	-	10	100.0	11
8	-	-	1	100.0	3	9	75.0	13
9	-	-	-	-	-	5	100.0	5
10	-	-	-	-	-	7	100.0	7
11	-	-	-	-	-	9	100.0	9
12	-	-	-	-	1	7	87.5	8
13	-	-	-	-	-	4	100.0	4
14	-	-	-	-	-	5	100.0	5
15	-	-	-	-	1	6	85.7	7
16	-	-	-	-	-	5	100.0	5
17	-	-	-	-	-	5	100.0	5
18	-	-	-	-	1	2	66.7	3
19	-	-	-	-	1	1	50.0	2
20	-	-	-	-	-	1	100.0	1
Total	8	-	10		7	82		107
Percent				90.0			92.1	
				July				
2	1	-	-	-	-	-	-	1
3	9	-	-	-	-	-	-	9
4	18	-	-	-	-	-	-	18
5	5	1	3	75.0	-			9
6	3	1	-	-	1	3	75.0	8
7	1	2	1	33.3	-	6	100.0	10
8	1	-	-	-	1	3	75.0	5
9	-	-	-	-	1	3	75.0	4
10	-	1	-	0.0	2	3	60.0	6
11	-	-	-	-	-	2	100.0	2
12	-	-	-	-	1	-	0.0	1
13	-	-	-	-	2	3	60.0	5
14	-	-	-	-	2	4	66.7	6
15	-	-	-	-	1	4	80.0	5
16	-	-	-	-	-	1	100.0	1
17	-	-	-	-	1	3	75.0	4
18	-	-	-	-	1	1	50.0	2
19	-	-	-	-	2	1	33.3	3
21	-	-	-	-	2	-	0.0	2
22	-	-	-	-	1	-	0.0	1
Total	38	5	4	44.4	18	37		102
Percent							67.3	

Table C-31. --Reproductive condition of female seals collected pelagically by the United States in the eastern Pacific, 1967-68 --Continued

Age	Nulliparous	Primiparous			Multiparous			Total
		Nonpregnant	Pregnant		Nonpregnant	Pregnant		
Years	Number	Number	Number	Percent	Number	Number	Percent	Number
				August				
3	10	-	-	-	-	-	-	10
4	17	-	2	100.0	-	-	-	19
5	2	-	1	100.0	-	-	-	3
6	2	-	1	100.0	-	1	100.0	4
7	-	-	1	100.0	-	6	100.0	7
8	-	1	-	0.0	-	2	100.0	3
9	-	-	-	-	-	2	100.0	2
10	-	-	-	-	-	1	100.0	1
11	-	-	1	100.0	-	1	100.0	2
12	-	-	-	-	-	3	100.0	3
13	-	-	-	-	1	2	66.7	3
14	-	-	-	-	1	3	75.0	4
15	-	-	-	-	1	3	75.0	4
16	-	-	-	-	-	5	100.0	5
17	-	-	-	-	2	2	50.0	4
18	-	-	-	-	1	-	0.0	1
19	-	-	-	-	1	-	0.0	1
20	-	-	1	100.0	1	1	50.0	3
Total	31	1	7		8	32		79
Percent				87.5			80.0	

Table C-32.--Pregnancy rates of female seals collected by the United States in the eastern Pacific, by area and month, 1967-68

Age	Washington											
	November 1967			December 1967			January 1968			February 1968		
	Seals	Pregnant		Seals	Pregnant		Seals	Pregnant		Seals	Pregnant	
Years	Number	Number	Percent	Number	Number	Percent	Number	Number	Percent	Number	Number	Percent
3	-	-	-	-	-	-	2	0	0	4	0	0
4	-	-	-	11	0	0	16	1	6.2	18	0	0
5	-	-	-	4	2	50.0	6	1	16.7	7	4	57.1
6	1	1	100.0	4	3	75.0	6	5	83.3	12	11	91.7
7	-	-	-	10	5	50.0	9	5	55.6	16	9	56.2
8	-	-	-	8	7	87.5	4	4	100.0	2	1	50.0
9	1	1	100.0	8	7	87.5	7	5	71.4	9	7	77.8
10	-	-	-	3	1	33.3	9	8	88.9	11	8	72.7
11	-	-	-	5	1	20.0	4	4	100.0	12	8	66.7
12	-	-	-	5	5	100.0	8	8	100.0	9	7	77.8
13	-	-	-	1	1	100.0	2	2	100.0	2	2	100.0
14	-	-	-	1	1	100.0	1	1	100.0	4	3	75.0
15	-	-	-	2	2	100.0	3	3	100.0	8	7	87.5
16	-	-	-	2	2	100.0	4	4	100.0	4	4	100.0
17	-	-	-	-	-	-	4	4	100.0	2	1	50.0
18	-	-	-	2	2	100.0	-	-	-	1	1	100.0
19	-	-	-	2	2	100.0	-	-	-	-	-	-
20	-	-	-	1	1	100.0	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	1	0	0	-	-	-	-	-	-
23	-	-	-	1	0	0	-	-	-	-	-	-

Age	Alaska											
	May 1968			June 1968			July 1968			August 1968		
Years												
3	3	0	0	-	-	-	9	0	0	10	0	0
4	5	0	0	8	2	25.0	18	0	0	19	2	10.5
5	4	1	25.0	4	2	50.0	9	3	33.3	3	1	33.3
6	2	1	50.0	10	10	100.0	8	3	37.5	4	2	50.0
7	6	6	100.0	11	11	100.0	10	7	70.0	7	7	100.0
8	3	3	100.0	13	10	76.9	5	3	60.0	3	2	66.7
9	4	3	75.0	5	5	100.0	4	3	75.0	2	2	100.0
10	3	3	100.0	7	7	100.0	6	3	50.0	1	1	100.0
11	5	4	80.0	9	9	100.0	2	2	100.0	2	2	100.0
12	6	6	100.0	8	7	87.5	1	0	0	3	3	100.0
13	7	6	85.7	4	4	100.0	5	3	60.0	3	2	66.7
14	5	4	80.0	5	5	100.0	6	4	66.7	4	3	75.0
15	1	1	100.0	7	6	85.7	5	4	80.0	4	3	75.0
16	5	4	80.0	5	5	100.0	1	1	100.0	5	5	100.0
17	2	2	100.0	5	5	100.0	4	3	75.0	4	2	50.0
18	2	2	100.0	3	2	66.7	2	1	50.0	1	0	0
19	2	2	100.0	2	1	50.0	3	1	33.3	1	0	0
20	2	1	50.0	1	1	100.0	-	-	-	3	2	66.7
21	1	1	100.0	-	-	-	2	0	0	-	-	-
22	1	0	0	-	-	-	1	0	0	-	-	-

Age	Combined data		
	Washington	Alaska	1958-68 pelagic collections
	Pregnant	Pregnant	Pregnant
Years	Percent	Percent	Percent
3	0	0	0.4
4	2.2	8.0	3.4
5	41.2	35.0	38.5
6	87.0	66.7	72.9
7	54.3	91.2	80.3
8	85.7	75.0	86.5
9	80.0	86.7	89.8
10	73.9	82.4	89.2
11	61.9	94.4	89.4
12	90.9	88.9	88.3
13	100.0	78.9	87.5
14	83.3	80.0	83.4
15	92.3	82.4	82.1
16	100.0	93.8	80.2
17	83.3	80.0	68.5
18	100.0	62.5	68.8
19	100.0	50.0	55.4
20	100.0	66.7	48.4
21	-	33.3	60.7
22	0	-	30.8
23	0	-	12.5

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